AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 14, No. 45. WEEKLY. | NEW YORK, THURSDAY, NOVEMBER 5, 1891. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

COPYRIGHT 1891, BY AMERICAN MACHINIST PUBLISHING COMPANY.

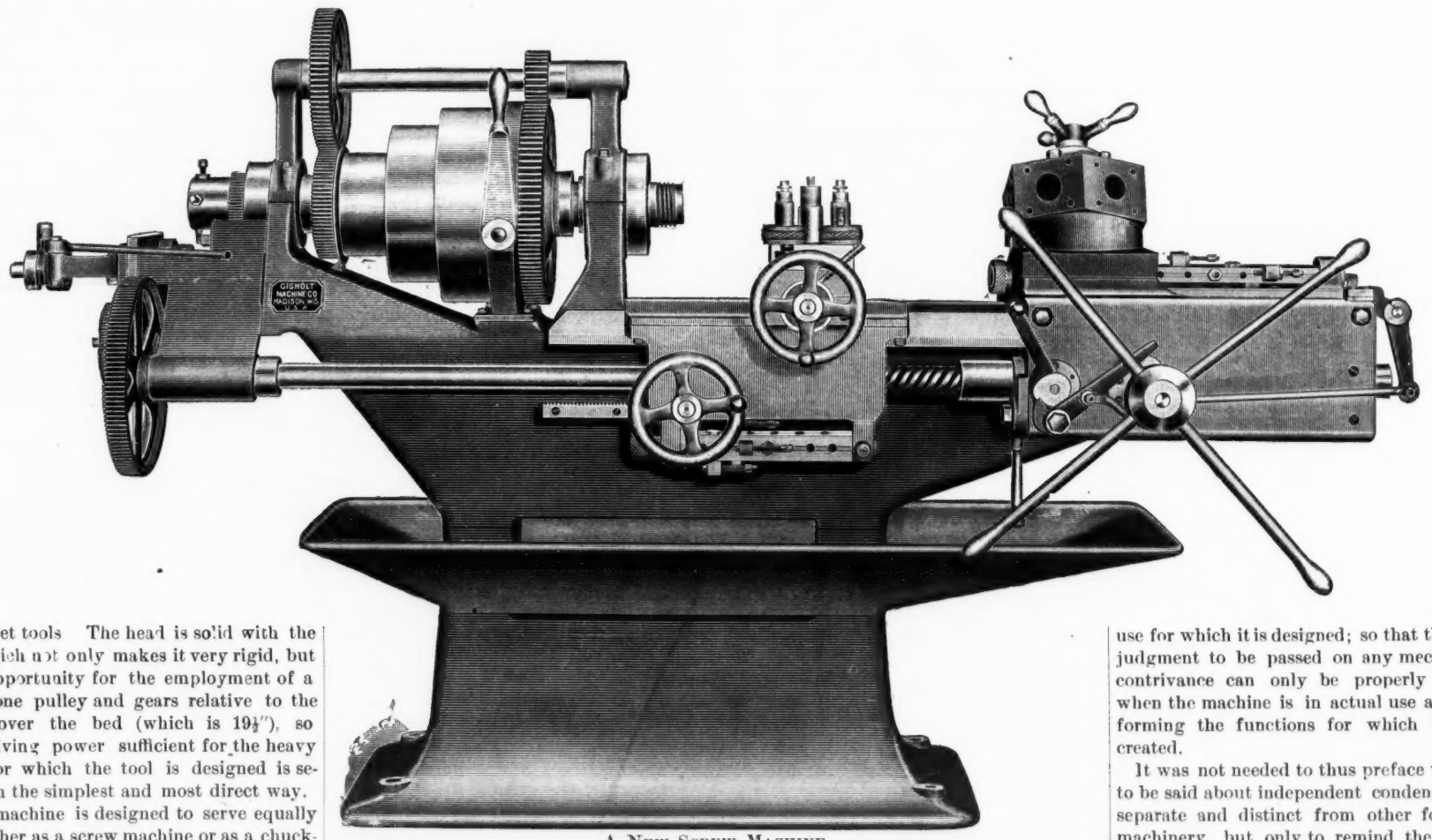
For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

A New Screw Machine.

We give on this page an illustration of a screw machine which, as will be readily perceived, differs quite materially in design from the usual machines of its class.

The most striking feature is the bed of the machine, in which the usual legs or columns at either end have been discarded, and the principal portions of the machine supported upon a pedestal which extends from near the extreme head of the machine towards the foot beyond where the carriage is used, the overhanging extension of the bed beyond this point being designed solely for resisting the stresses brought upon it by the turret tools The head is solid with the bed, which not only makes it very rigid, but gives opportunity for the employment of a large cone pulley and gears relative to the swing over the bed (which is 19½″), so that driving power sufficient for the heavy work for which the tool is designed is secured in the simplest and most direct way.



A NEW SCREW MACHINE.

The machine is designed to serve equally well either as a screw machine or as a chucking machine, so that it may be used advantageously in shops which would not have work enough of one kind to keep it fully employed.

The bed is 16″ deep and has a V in front for the carriage, and a flat surface behind, the V being 3½″ wide. The spindle is of crucible steel ground true on dead centers, is 3½″ diameter at the front bearing, and has a hole through it 1 ⅛″ diameter. The front bearing is of an improved form, which makes it easy to preserve the alignment of the spindle, which is driven by a 3½″ belt, and there is a friction clutch which admits of the speed being changed from back gear to cone pulley without stopping the machine. This clutch is of an improved form, securing very large friction surfaces with corresponding durability. It can be adjusted from the outside.

There are four rates of feed with each set of change gears, these different rates being instantly available by simply moving a lever, which can be done without stopping.

The turret slides directly on the ways of the machine, and is thus supported by the same length of bearing surface at all times, this surface, moreover, bearing always the same relation to the position of the turret. It revolves in a plane which is inclined backward in such a way that the turret tools clear the tool-post on the carriage by passing over it. It has a movement of 25″, and there is a stop bar on the turret slide, to which a stop is attached for each face or hole in the turret, so that a stop can be set independently for each tool, and it is unnecessary to be particular about having the tools project from the turret the precise distance required for the different operations. The same kind of stop bar is provided for the carriage, this one being provided with four stops—one for each tool. The hexagonal form of the turret gives opportunity for fastening tools or fixtures to the various faces when required, in addition to which there are the regular bored holes with clamping devices.

The turret is fed by the coarse pitch lead screw seen in front, which works in a nut 30″ long, this nut being supported in bearings arranged to let it revolve with the screw when not feeding. It is connected by miter gears to the pilot wheel shaft, and when the power feed is wanted is simply prevented from turning with the screw by a suitable locking device, which is released automatically at the proper point, the release for each tool in the turret being independent of all other tools. There is also an independent dead stop for each face of the turret. The turret can be made to rotate automatically at any desired point by simply adjusting a dog.

The carriage is moved by hand, and has a traverse of 15″. It carries four tools, each independently adjustable for height, and mounted upon a turret tool-post which revolves to bring any desired tool to the cutting position, this post being indexed by a hardened steel pin. Traversing screws are graduated to indicate .001″ of movement. An oil pump is provided, and there is a suitable receptacle for oil and chips. The machine is built either with or without carriage, back gears or oil pump, and in case back gears are not wanted, the cone pulley may have three steps for a 4½″, or four steps for a 3½″ belt, as may be desired. All sliding surfaces are fitted by scraping to standard surface plates, and pains are taken to secure good work throughout. The machine is built by the Gisholt Machine Co., Madison, Wis.

A Correction.

The slide rule, illustrated on page 6 in our issue of October 29, is named by its inventor, the "Proportior." Through a typographical error, it was named the "proportion" in the above issue. Although this error may cause confusion in making inquiries, it in nowise detracts anything from its value and advantage, demonstrated through several years of use.

The Pennsylvania Railroad Company is having a new steel screw ferryboat built at Roach's yard in Chester, Pa. It is said that the boat will be called the "Washington."

Mrs. Hattie M. Kimball has been elected president of the Pennsboro & Harnsville Railroad.

The Superiority of Independent Condensers for Marine Engines on the Lakes.

BY J. F. HOLLOWAY.

The value of any piece of mechanism is the difference between the sum of all its good features, minus its bad ones; for it will be conceded by all, except possibly the inventors of special contrivances, that all machines possess both good and bad features.

Again, the value of a machine is not to be judged alone by the good and bad that is in the machine itself, but, in addition, by the adaptation it possesses for the purpose or use for which it is designed; so that the final judgment to be passed on any mechanical contrivance can only be properly passed when the machine is in actual use and performing the functions for which it was created.

It was not needed to thus preface what is to be said about independent condensers, as separate and distinct from other forms of machinery, but only to remind the reader that while it may be possible to prove many things as being theoretically failures, yet the fact often remains that they are practically and commercially a success.

It is not the purpose of this article to enter into a discussion of the theory of steam condensation as applied to lake marine engines, or as to a comparison of the different methods by which it is or can be brought about, but rather to show how independent condensers contribute not alone to the economy of steam propulsion, but in many ways to its safety and reliability. While it has not come to the knowledge of the writer that careful and exact experiments have been made on the lakes by which the theoretical or apparent value of any one condensing apparatus over another has been demonstrated, yet some facts have been established by long experience, which are still unquestioned. It has long been known to the older engineers on lake steamers, referring back to the old days of low-pressure engines, and still verified in the newer and higher pressures now used on compound and triple-expansion en-

gines, that it was always better and more economical to sacrifice some several inches of vacuum in the main steam cylinders, in order that the injection water from which, after it had passed through the condenser and air-pump, the boiler feed water was taken, should have its temperature raised to a corresponding degree. To just what extent this was carried by different engineers depended alone on their observations as to what vacuum and what temperature of feed water produced the best results in their engines, both as to the economy of coal for certain speeds, and also upon the fact of just how cold the feed water could be used without starting leaks in the boilers; depending as that often did as to the point on the boiler to which the feed pipes were attached; but in a general way, a loss of from two to four inches of vacuum was deemed a [illegible] justifiable one.

The service to which marine engines of the lakes are subjected is, in many ways, exceptional, and perhaps, outside of those familiar with it, not well understood. It is within the memory of many that the screw steamers on the lakes, first used, were but small wooden hulls of from three to six hundred tons burden, and were driven by small non-condensing engines worked by a starting bar. The ease with which these small vessels were worked in and out of port by the dexterity of their engineers, emboldened captains to often take chances in their maneuvering that would startle the more conservative skipper of the East. Later on, larger vessels came into use, and with them large engines of the condensing type, bringing with them additional complications of machinery and additional risks in handling them; and so on up to the present date, hulls and engines have been constantly growing larger and heavier, until they now rival in size, as they almost outrival in number, the steamships that float in and out of our sea-coast cities. While the number and size of steam vessels on the lakes have wonderfully increased, the rivers through which they pass and the harbors into which they must enter remain, except as to the depth of water, as they were many years ago.

From this hasty glance at the evolution of the lake steamer, it will readily be inferred that the risk of navigation must of necessity be much increased, and the necessity for a prompt and effective handling of the engines is now more imperative than ever before.

Now, in what way can an independent condenser be made to contribute to the economy of use and positiveness of action of the lake marine engine, and in what way can it, by so doing, assert its right to recognition and adoption?

In the first place, an independent condenser of the Worthington type is a separate and distinct mechanism, having only one function to perform, and one which is in no wise greatly affected by the motion or rest of any other part of the machinery of the boat. The independent condenser can be set in motion before the main engine is started, and it can remain in action after the main engine is at rest, without involving any particular care from the attendant engineer. As before stated, the risks of navigation have of late years been largely increased, not only by reason of the large number of steamships afloat, but as well by their increased size, which makes their passage through narrow rivers and contracted water-ways a frequent and unavoidable danger. Then, again, the small harbors of the lakes are crowded with floating craft of all kinds, which, taken in connection with the narrow space between the piers and the sharp bends, makes the passage of heavily loaded boats a constant source of anxiety, not only to the master of the steamer, but as well to all those who happen to be near him. This fact exemplifies the necessity of a prompt response of the engines of a ship to the requirements of a somewhat at times dangerous situation.

Having thus briefly outlined the necessities and requirements of a navigation which is entirely familiar to those living on the western lakes, but quite unknown elsewhere, it will be proper to indicate in what manner the difficulties of the situation are helped by the use of an independent condenser, in place of the attached air-pump and condenser.

In the first place, the attached air-pump and condenser being driven by the main engine is dependent alone on the same for its movement; the independent one, as has been shown, is not. In the compound, triple-expansion or simple-condensing engine, a large part of the total power of the engine is dependent upon the efficiency of the vacuum produced by the condensation of the steam used, and it is obvious that in starting such an engine its first movements must of necessity be slow and sluggish, until the engine has made a sufficient number of revolutions to establish a good vacuum, the number of revolutions and the length of time depending largely on the condition of the air-pump and its connections. Now, it can readily be understood that in narrow water-ways, and in crowded harbors, there is certain to come occasion when the engine must be stopped, reversed and started in the shortest possible length of time, and at such times a constant, strong vacuum is a most desirable barrier against damage or disaster. To sum up the objections to the attached air-pump and condenser on a lake engine where it must be so often stopped and started, it may be added that the attachment of the air-pump to the main engine increased the number of parts of the main engine liable to get out of adjustment, and it prevents that ready access to the crank pins and main journals, which, at the high speeds they are now run at, require not only constant care and attention, but also ready access for examination and repairs. The high speed now required of the main engine greatly increases the strains on the air-pump beams, links, buckets and valves, and the high velocity with which the injection water is lifted and forced through the air-pump, often causes rupture of the air-pump cover, its connection pipes and valves. This engine speed has of late years so increased, that the usual large rubber valve of the air-pump bucket, foot and discharge valve can be used now only at a very considerable risk, and it involves, as well, the selection of the very best material. The use of an attached air-pump and condenser necessitates much additional labor and watchfulness on the part of the attendant engineer when working a vessel in or out of port, an operation not unusually requiring a constant handling of the main engine for several hours. At every stopping of the engine, the injection must be closed, and again opened when the engine is set in motion, and is it to be wondered at, that, when this labor goes on for hours, it is possible that the injection valve may at times be forgotten, and the result a flooded air-pump, and, as it sometimes happens, a broken one, should the engine be put instantly into rapid motion.

The operation of the independent condenser as connected with a lake marine engine, being to some extent a new departure, as applied to such marine engines, it may be well to explain wherein it possesses merits that should commend it to a wider use. In the first place, an independent condenser, when in use, will produce a constant and reliable vacuum on the engine at all times, irrespective of the action of the main engine, and will not require the special attention of the engineer while working the engine. The degree of vacuum produced by the independent condenser is not limited by any consideration of the temperature of the feed water; therefore, it can produce the highest attainable results, varying from 26 to 27 or more inches, instead of 22 to 24, as it is commonly carried with the old-style air-pump and condenser, and thus adding largely to the power of the main engine as well as to its instant availability. The moderate and steady action of the independent condenser is a guarantee of its endurance and reliability, of great value to a steamer, especially in times of danger.

Another and important feature of the condenser of the kind mentioned above is, that in its design and construction, especially as to the form of its condensing chamber, and in the inflow of the injection water, advantage is taken of the somewhat mysterious impulse imparted to water when it flows into a vacuum made by its union with steam moving in the same direction, as is illustrated not only in the ordinary injector, but especially by that peculiar and wonderful ejector, which, by simply using a portion of the exhaust steam of a non-condensing engine, forces the feed water into a boiler, and against heavy steam pressure. The currents of the inflowing injection water in the condensing apparatus referred to are always in the direction of the outlet, and it never comes to a state of rest while in the condenser or in the air-pump, and there never comes a time during this movement when the entrained vapor and air is allowed to free itself from the water, until the whole is discharged overboard; and the efficiency of the machine is, in part, due to this rapid swirling action of the inflowing water that sweeps out from all nooks and corners entrained air which otherwise would impair the vacuum.

The objection that will be raised, and possibly the only one, will be that the independent condenser, which is in so many ways desirable, does not use steam economically; or, in other words, less steam will be used when the air-pump is attached to the main engine. As was said in the beginning, the value of a machine is the difference between its good and bad features; now, having shown, in part at least, the good features of the independent condenser, let us look into the question of its cost in steam consumption. It always takes a certain amount of power to produce a certain amount of work, but it does not always take a certain and fixed amount of steam to do a certain and fixed amount of work, for in some cases the steam is used to its best advantage, while in others it is not. The value of steam is in its temperature; high temperature means high pressure, and high pressure means large expansion. In driving an attached air-pump the steam used is worked at its greatest economy, by reason of its being used expansively in the steam cylinder or cylinders of the main engine, and its pressure and temperature is reduced by the work it has done, but the final temperature it retains when exhausting is, in the main, thrown away in raising the temperature of a large volume of injection water, of which only a small part can be utilized in feeding the boiler. The steam used in a direct-acting independent condenser cannot be used expansively, consequently it requires a larger volume to do its work, but it retains at the end of its piston stroke a larger per cent. of the high temperature it originally had, and, if it were then exhausted into the atmosphere, there would, of necessity, be a great loss of heat, which always means loss of coal in such cases. But by the use of a coil or tubular heater, through which such a portion of the injection water is forced as is required for feeding the boiler, the exhaust steam from the independent condenser is utilized to its full extent by extracting from it its remaining heat and transferring it to the boiler again, through the medium of the feed water, and therefore there is virtually no loss of steam or power beyond what is required to discharge the injection water overboard, and overcome the resistance of the working parts of the machine. By using this feed water heater, the steam from the auxiliary feed and other pumps can also be returned to the boiler, thus saving what heat otherwise would usually be wasted in their exhaust steam.

To sum up in brief the advantages arising in the use of independent condensers on lake marine engines, would be to say that by their use the highest obtainable vacuum can be had in the cylinders of the main engine, and the highest degree of temperature be at the same time imparted to the feed water, thus increasing the power of the boiler, and contributing greatly to its durability. The slow speed at which such a condenser, when properly selected, runs, insures freedom from undue wear, and liability to derangement. By its use the main engine is rendered more accessible and is relieved from a serious source of danger, to which it otherwise would be liable, by reason of its being connected under high speeds with the moving parts of the ordinary attached air-pump and connections. By its use the condenser can be placed at any convenient location without reference to the main engine. And more than all else, by its adoption any condensing engine can be as rapidly and promptly handled as in the old times were the smart high-pressure lake engines, which for size, power, endurance and durability have never since been equaled.

Prof. Sweet's Ideas Tested.

BY ALBERT F. ZAHM.

Having read in your columns the original proposition and subsequent discussion of Prof. Sweet's scheme of an "industrial university," it occurs to me that many of your readers would be interested to learn that there is a similar school in existence, that it has been tried above twenty years, and that it has given satisfaction. It is known as the Notre Dame Manual Labor School, and is situated in the neighborhood of the university of that name at Notre Dame, Ind. It was established to enable poor boys to learn a trade, and comprises the branches of drawing, pattern making, carpentry, cabinet making, plumbing, blacksmithing, tailoring, shoemaking, printing, and several others. Each boy is confined to a single trade, and works for the local market as a means of income to the school. The course of training requires "eight hours a day five and one-half days in a week, and at least fifty weeks in a year of faithful shop work; two hours a day five days in the week for study, recitations or drawing, and two hours each evening five days in the week for writing, lectures and study."

In many other respects it seems to realize the professor's ideas with singular minuteness, but not in all respects. He advises to "select men for teachers and instructors for the shop proper, whose *sole* qualifications are that they know how to do work, how to go to work to do a job, who are ready in resources and know the kinks in the trade, entirely regardless of whether they know how to design machinery, whether they know what makes a steam engine go, or whether *they can read or write*, except if a man knows how to read he may be better able to find out other people's ways, and therefore be the better man for the place." In addition to the above qualifications, the workmen of this school are required to have at least an elementary education, and to be men of *morals and manners*. American gentlemanliness is largely a product of instruction and example. If, therefore, a boy is to remain under a workman eight hours per day for several years, the workman should be more than a technical instructor. Prof. Sweet will surely agree in this.

As an illustration of what such boys can do in a machine shop, allow me to give some of my experience in the Mechanical Engineering Department of Notre Dame University. In addition to the regular students of the university and their instructor, we have a skillful foreman engaged in building machinery, and four boys from the Manual Labor School who do the job work and assist in building machinery. Among the products of the past ten months may be mentioned the following:

Twelve speed lathes valued at.....	$600.00
Two engine lathes "	500.00
One Corliss engine (50 H. P.) valued at .	1,500.00
General job and repair work, " ..	400.00

In addition to the above, several smaller engines, some dynamos, and a great many tools, such as taps, reamers, twist drills, etc., were made. The work of the pattern shop proved equally satisfactory and encouraging financially. Patterns were made for a shaper, an engine lathe, and some speed lathes of new design to be constructed by the same boys. The difference between the work of students of Mechanical Engineering in a machine shop and of boys

learning the machinists' trade is this: the former have but a few hundred hours at graded exercises, never repeating the same exercise once thoroughly learned; the latter, after doing the exercises, labor steadily at a great variety of commercial work, to acquire not only knowledge, but, rapidity and accuracy of execution. In acquiring this accuracy, of course, a great deal of work is ruined, and it is sometimes very exasperating to the foreman; but the work may be so apportioned that the smaller parts fall to the less skillful student, and, if ruined, may be replaced.

No school produces a very skillful mechanic, nor a very competent engineer; but a school adapted to its aims may, besides giving the student a moral training, advance him in either trade or profession more rapidly than the busy world does. Many a skillful veteran regrets his early inopportunity for study, and many a skillful young machinist would gladly work for board and tuition. In a financial way, the young machinist of some months experience would, as a student, be preferable to the beginner. I have had some boys of that kind, and am disposed to receive more in so far as they do not interfere with the classwork of the university students.

This, I trust, will count as a vote in favor of Prof. Sweet's plan. The Notre Dame Manual Labor School is not a complete realization of his ideas. It has but a local market, a limited equipment, and a professedly limited number of boys. Given, however, a desire for extension, and a shrewd business man at the head, the school could be indefinitely enlarged. I hope some day to hear of a thorough trial of Prof. Sweet's suggestions.

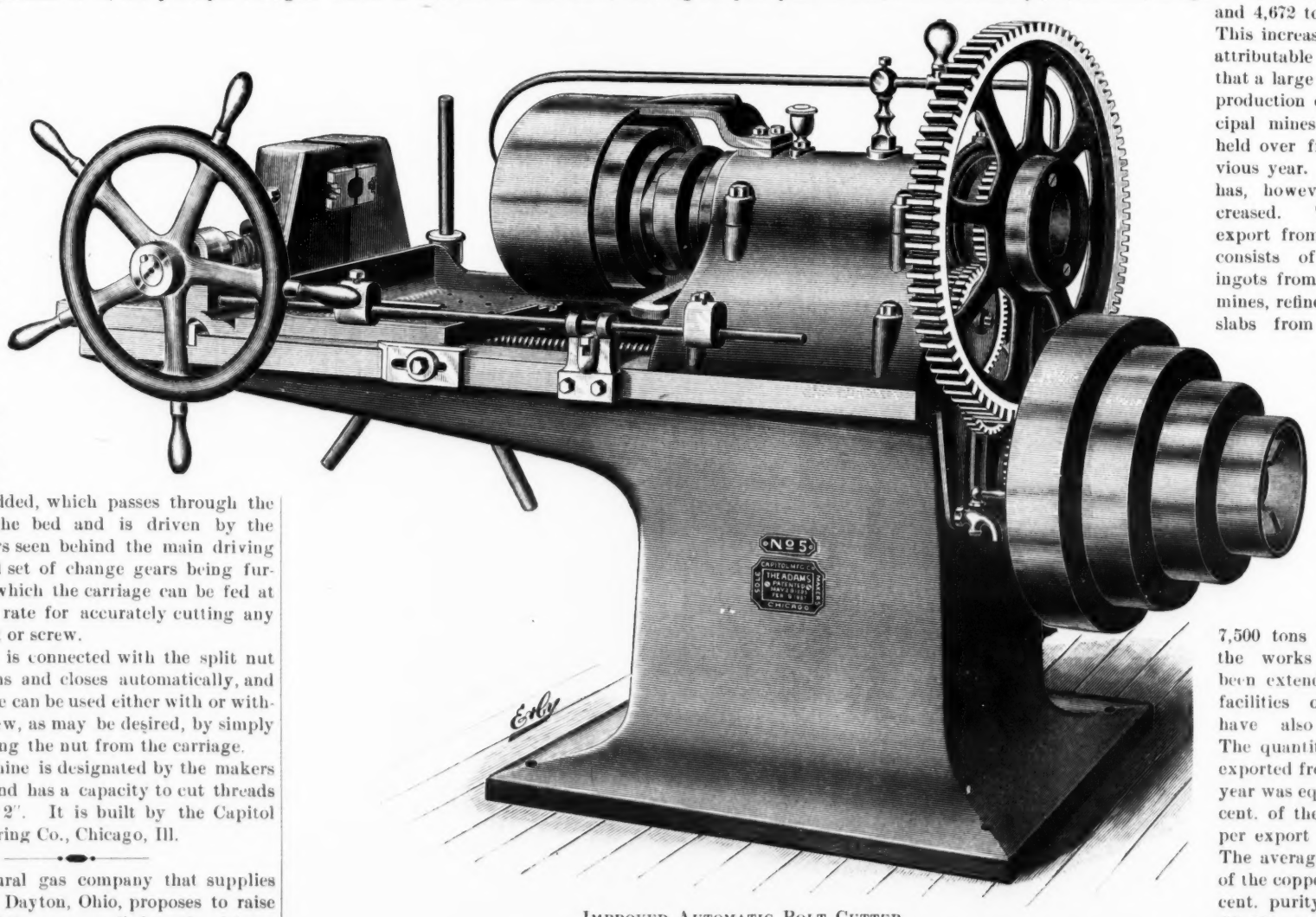
Improved Automatic Bolt Cutter.

In former issues we have described the features of the Adams automatic bolt cutter which are peculiar to it, the principal one of these being, perhaps, the head, which is arranged to open when the thread is cut, and is yet so made that, when closed, the die is practically solid, so far as its working is concerned.

In the present machine, a lead screw has been added, which passes through the center of the bed and is driven by the change gears seen behind the main driving gear, a full set of change gears being furnished, by which the carriage can be fed at the proper rate for accurately cutting any desired bolt or screw.

The vise is connected with the split nut which opens and closes automatically, and the machine can be used either with or without the screw, as may be desired, by simply disconnecting the nut from the carriage.

The machine is designated by the makers as No. 5, and has a capacity to cut threads from ¼″ to 2″. It is built by the Capitol Manufacturing Co., Chicago, Ill.



IMPROVED AUTOMATIC BOLT CUTTER.

The natural gas company that supplies the city of Dayton, Ohio, proposes to raise the price of the gas supplied to the citizens by about 150 per cent. The citizens object to this, claiming that the original contract has still eighteen years to run.

A correspondent of a daily paper asserts that the inferior quality of the electric lights in London is due to the atmosphere, and not to the appliances used for producing the lights.

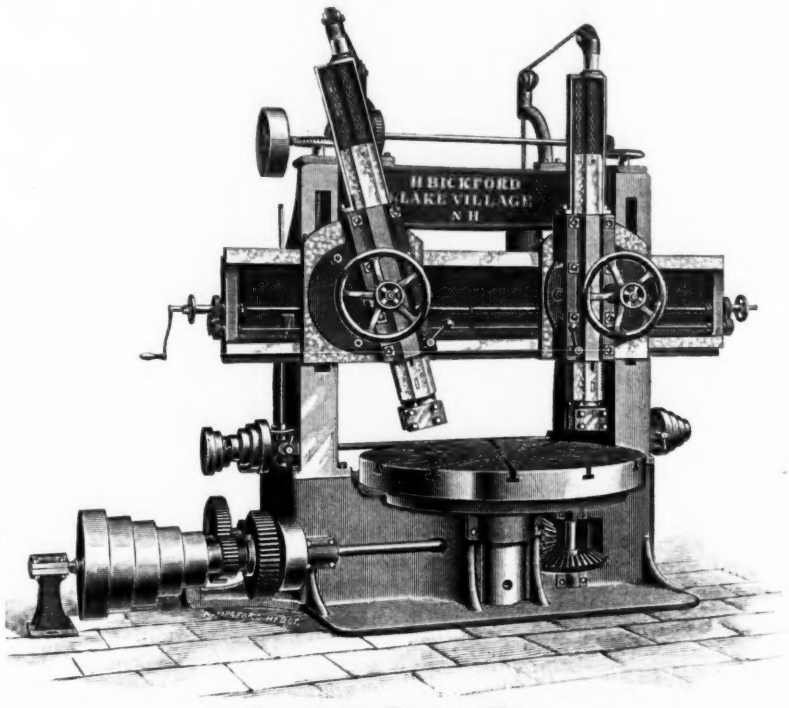
Boring and Turning Mill.

The engraving on this page represents a newly improved boring and turning mill, which is built by H. Bickford, Lake Village, New Hampshire. The mills are provided with two saddles and tool bars which are fed independently in either direction, the right-hand bar passing over the center for boring. The tool holders are of steel, and are adapted to hold tools in any desired position. Bars have quick-return motion, and can be clamped when facing. They are hexagonal in cross-section, scraped to a bearing in the saddle, and are counterbalanced.

A spur gear is used for the main driving gear which is attached to the table, the arrangement of the driving mechanism being made plain by the engraving.

The table spindles are 4 feet long, with journals 8 and 6 inches diameter. Cone pulleys are for a 4-inch belt, and the proportions of this and of the gearing are such as to secure powerful driving. The cross-rail is adjusted by power driven from the countershaft, and no extra counter is required.

The mills are built in a new shop equipped with tools especially adapted to the work, and devoted exclusively to the building of boring and turning mills. The cut represents the 4, 5, and 6-foot sizes, the first named taking work 30″ high under the cross-rail, the others 36″ high.



BORING AND TURNING MILL.

Narrow Gauge Railways in France.

The advantages of cheap light railways are in no country more thoroughly recognized than in France, where the practice of economy and efficiency is endeavored to be carried out to its furthest limit. In accordance with a scheme formulated by the government, narrow gauge railways have, during the past year or two, been extensively laid down throughout the country, and it will take another three or four years of active railway construction before the scheme is fully completed. Under these circumstances the experience of French engineers with light railways may be worth citing. Hitherto such railways in France have generally had a gauge of 60 cm.—about 24 in.—and this gauge has been popularized by a company that has practically a monopoly of its manufacture. The railways of 60 cm. gauge have been pushed by sheer enterprise, not only in France, but also in South America, where the railway is very considerably used. The company who manufacture this material, and who claim to be the largest makers of light railways in the world, have lately found that the demand is seriously falling off. This is attributed to the fact that the railways of 60 cm. gauge —24 in.—are losing favor among private users, who find that they are not so convenient as railways of a somewhat broader gauge. They assert, indeed, that the 60 cm. gauge, while being useful for many purposes, does not in the end attain the economy by which alone such a narrow gauge can be justified, and that without extra appreciable cost a railway of a broader gauge can be used, that is capable of a wider scope of usefulness than the rolling stock of the well-known Decauville type. Another simple though unquestionable drawback to the general employment of 60 cm. gauge railways is the sense of insecurity which they provoke among the public, who are somewhat nervous of the apparently top-heavy locomotives running upon narrow tram lines. Under these circumstances, there is being experienced an increased demand for railways having a gauge of a meter. It is the opinion of many French engineers that this gauge will in the future be most generally adopted; for, apart from the advisability of having a uniform narrow gauge for all secondary lines, the difference between the slight extra cost and the efficiency is all in favor of railways of a meter gauge.—*The* (London) *Engineer*.

Japanese Copper Mines.

According to a recent official report the export of copper from Yokohama showed a large increase last year. It amounted to 11,409 tons, as against 3,255 tons in 1889, and 4,672 tons in 1888. This increase is mainly attributable to the fact that a large part of the production of the principal mines had been held over from the previous year. Production has, however, also increased. The copper export from Yokohama consists of Furukawa ingots from the Ashiwo mines, refined in Tokio; slabs from the Kusagurai Segawa, Nosawa, Washinosu, Kodama and Mitsusawa mines.

The production of the Ashiwo mines is now estimated at 7,500 tons per annum; the works there have been extended, and the facilities of transport have also improved. The quantity of copper exported from there last year was equal to 93 per cent. of the whole copper export of the port. The average local value of the copper, of 99 per cent. purity, was about £3 10s. to £3 13s. per picul (133⅓ lbs)—*Industries*.

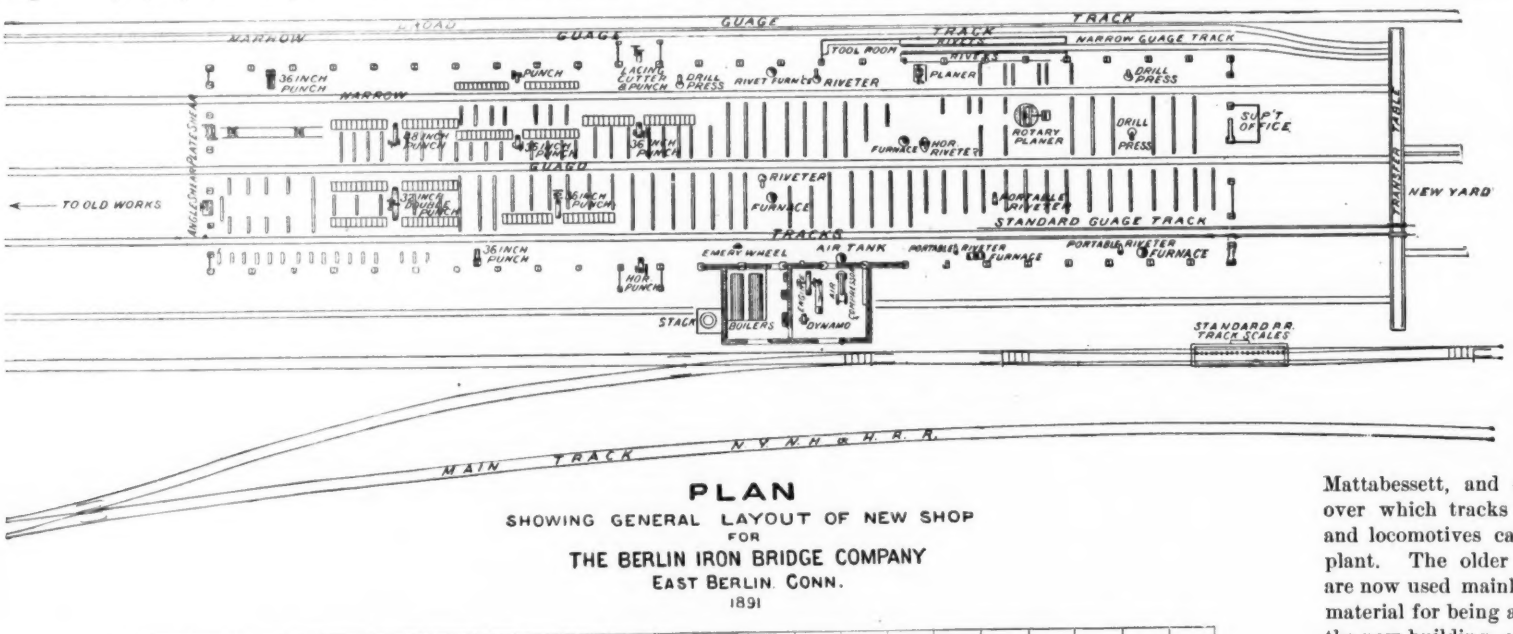
The Pennsylvania Railroad Company has issued strict orders as to the disinfecting of all places on its lines, and about its stations as well as its cars, and to the seeing that all drinking water shall be as good as can be had. This is a thoroughly good move and should be followed on other roads.

New Works of the Berlin Iron Bridge Company.

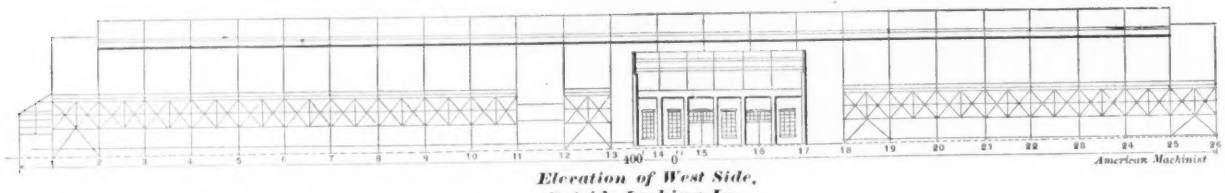
The great importance of properly arranged and properly built shops in which to carry on manufacturing operations is now better understood than ever before, and the science of shop-building is attracting a great deal of attention. We think, therefore, that none of our readers will begrudge the space given up this week to our illustrations of the new building of the Berlin Iron Bridge Company at East Berlin, Conn., who, having given special attention to the designing and building of shops for some years, have endeavored in the construction of their own new building to embody in it all the features which extended experience and exhaustive study of the subject had convinced them were desirable in such a structure.

Our engravings show the building so completely as to make a detailed description unnecessary, and we shall give only such points regarding the works as were noticed by a representative of this paper during a recent visit to them.

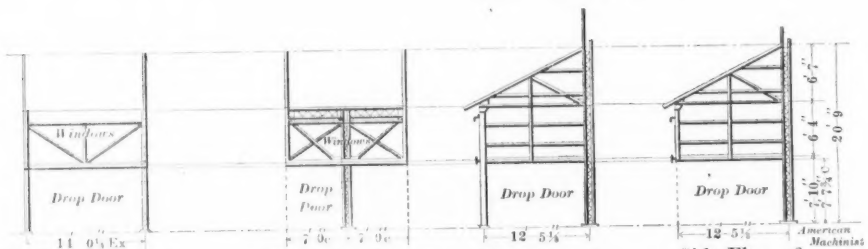
The new building shown does not by any means constitute all of the plant, but is simply the latest addition to it, the older part of the works being on the opposite side of the Mattabessett, and connected by a bridge over which tracks are laid, so that cars and locomotives can reach any part of the plant. The older portions of the works are now used mainly for the preparation of material for being assembled and erected in the new building, or in the yards adjacent to it, there being extensive blacksmith shops in which the forging is done by use of machinery mainly, among the tools noticed here being a 4,500-pound steam hammer which is employed in forging eye-bars. There is a machine shop in which punches and dies are made, and in which also some special machinery is constructed and repairs kept up.



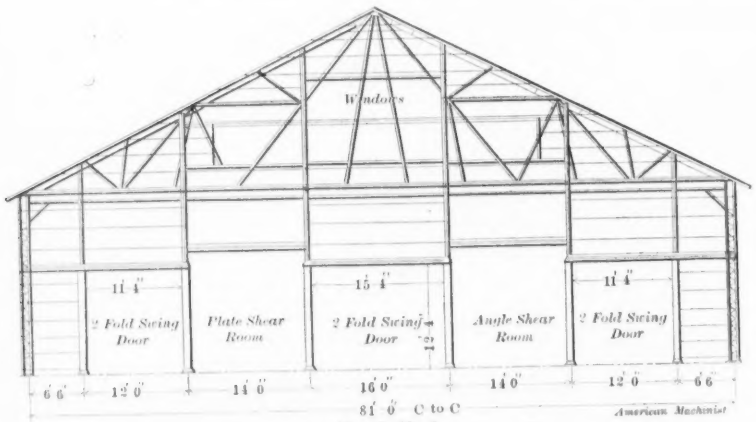
PLAN
SHOWING GENERAL LAYOUT OF NEW SHOP
FOR
THE BERLIN IRON BRIDGE COMPANY
EAST BERLIN, CONN.
1891



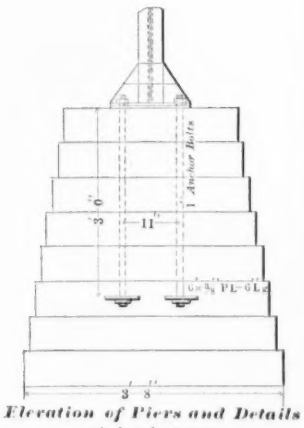
Elevation of West Side, Outside Looking In.



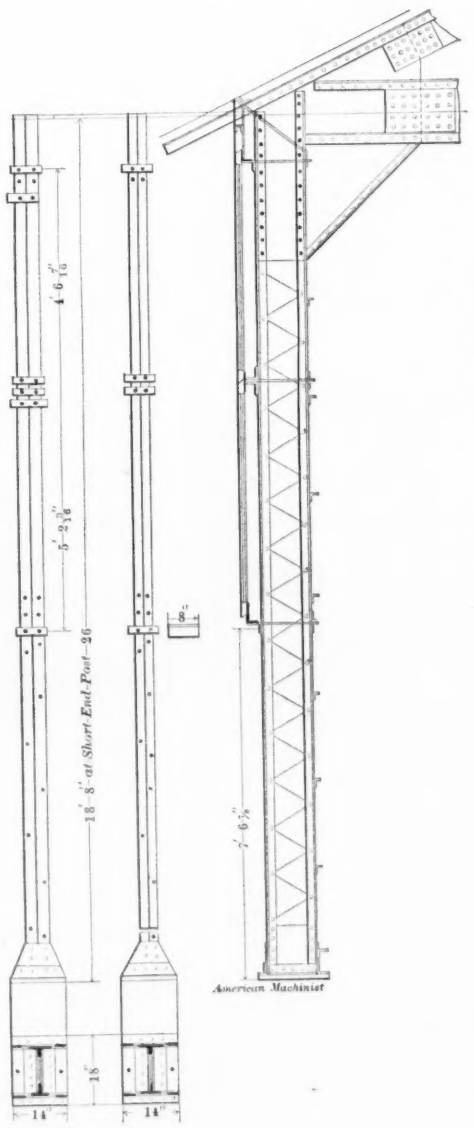
End Elevation of Plate Shear Room. *End Elevation of Angle Shear Room.* *Side Elev. of Plate Shear Room.* *Side Elev. of Angle Shear Room.*

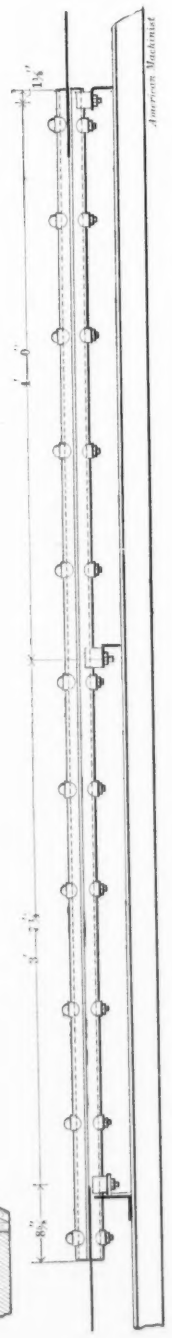


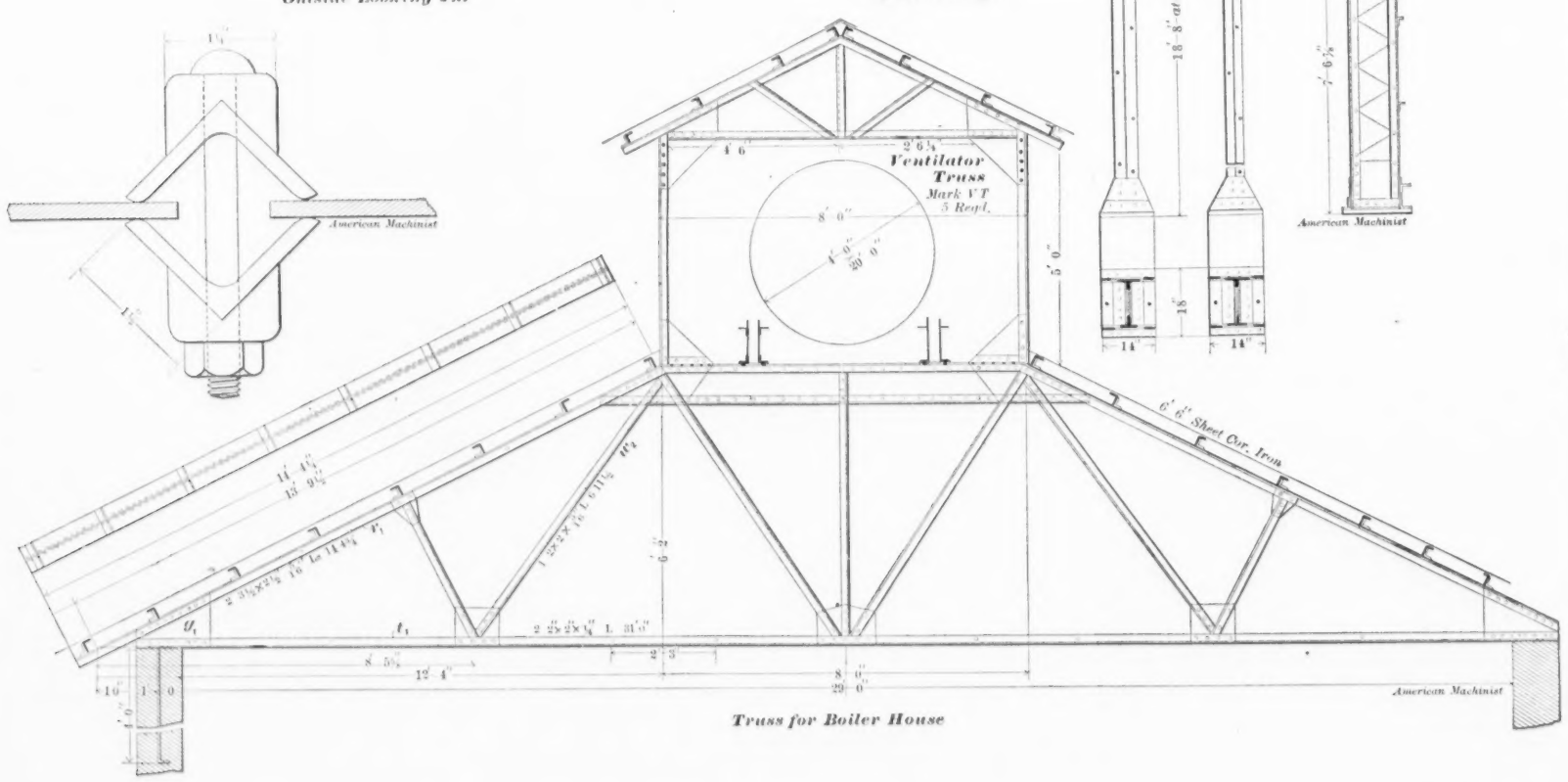
North End. Outside Looking In.



Elevation of Piers and Details of Anchorage





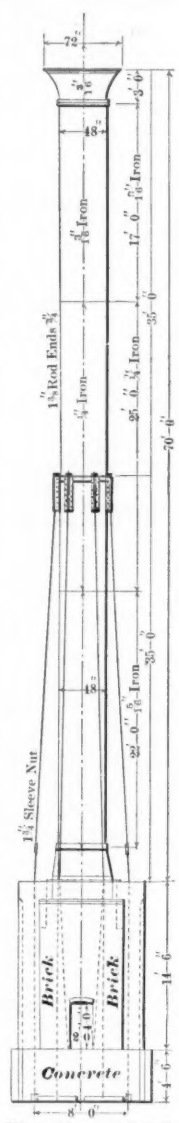


Truss for Boiler House

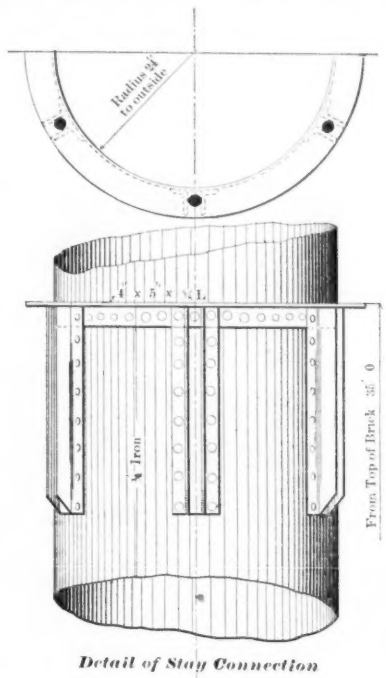
Twenty-five to thirty draftsmen are steadily employed, besides which there are two draftsmen whose business it is to go carefully over every drawing, for the purpose of detecting any possible errors. The drawings then go to a department in which every truss or other part of a structure is laid out full size on the floor and constructed in wood, every hole being bored in the wooden parts exactly as called for by the drawings, these wooden parts being then used as templates for laying off the work, after it is found beyond the shadow of a doubt that everything is all right, and that the parts will go together properly. This part of the works reminds one very strongly of shipbuilding, the lines being laid out on the smoothed floor full size, in very much the same manner. Two long tables stand near the wall, in the middle of each being a vertical boring machine by which holes are bored, those members which are to be riveted or bolted together being bored simultaneously.

Referring to the plan of the main or new shop as shown on page 4, the movement of the work through it will be understood by noting the location of the tools, the material entering at the left, encountering first the various shears by which it is cut to proper form and length, afterward reaching the punches, and being then put together and riveted. It is then finished up where required by ordinary or rotary planers and passes out at the right, no work being allowed to move in the contrary direction.

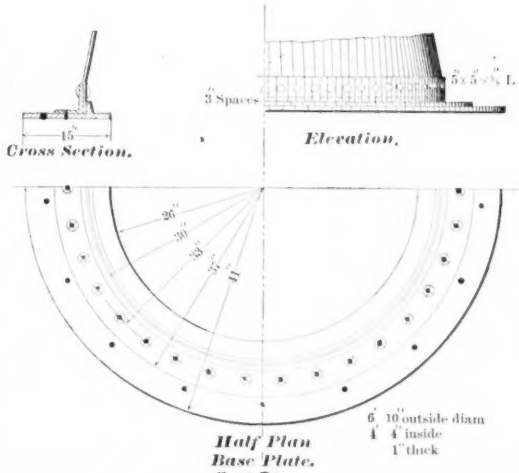
All the tools seen here are of the most modern and approved construction, many of them being provided with engines of their own, and all heating of rivets, or other parts, is done in furnaces using oil as fuel, so that they require little or no attention while running, and there is no dirt to contend with nor ashes to be removed.



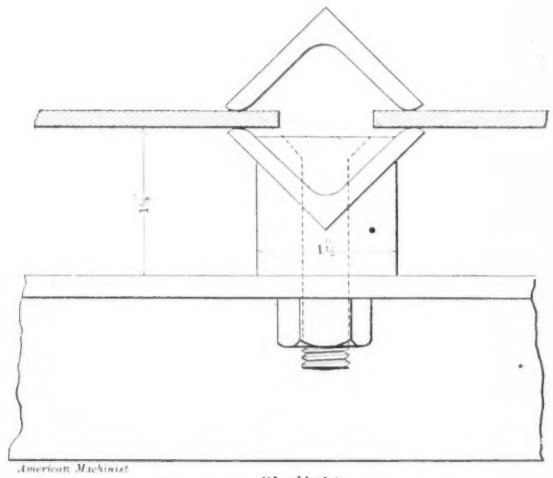
Elevation of Stack.



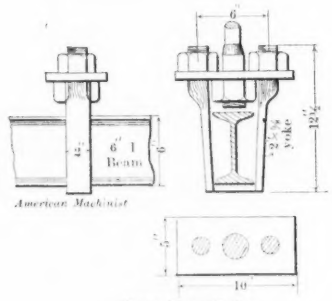
Detail of Stay Connection



Half Plan Base Plate. Cast Iron.



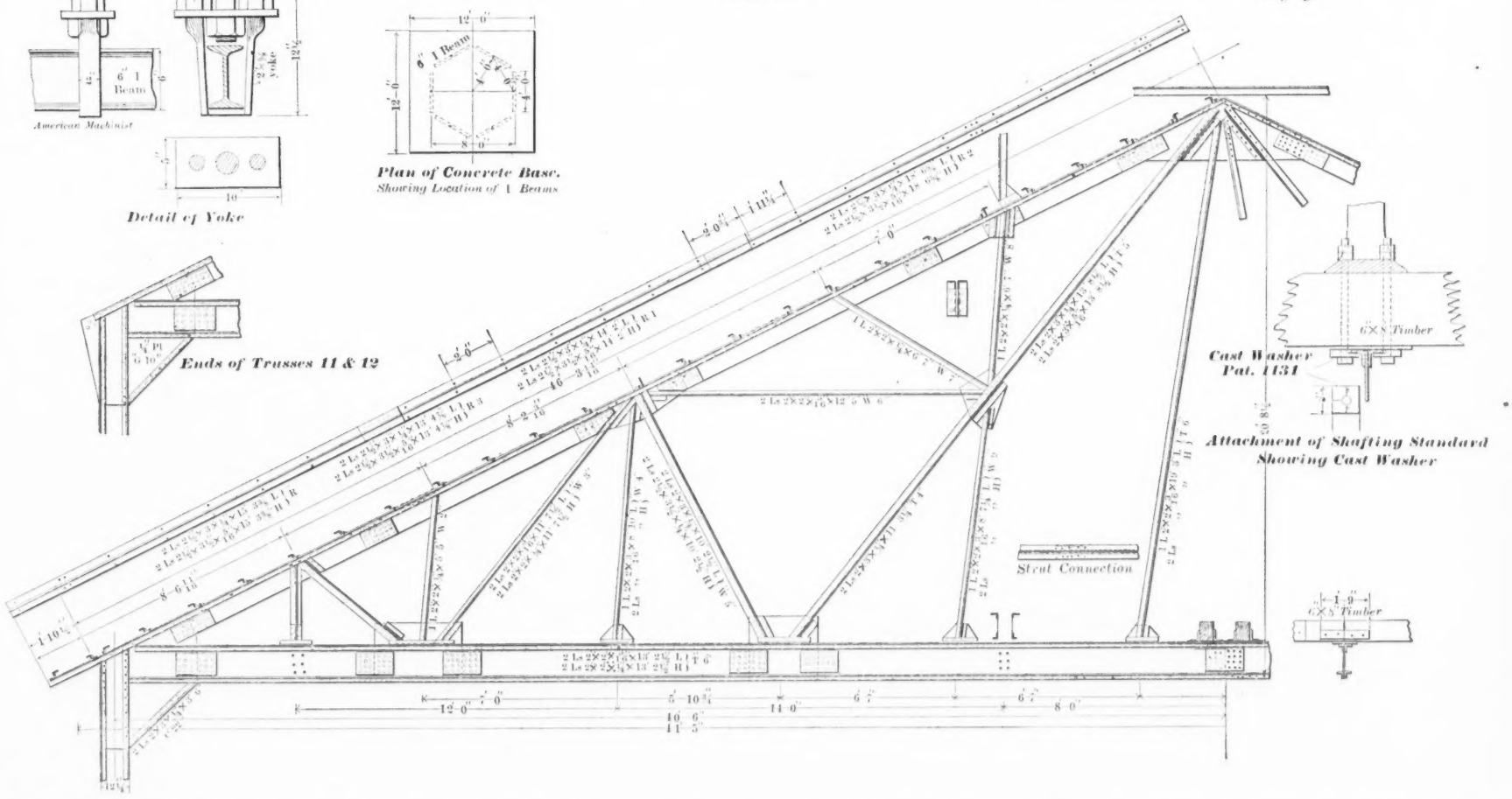
Skylight



Detail of Yoke

Plan of Concrete Base.
Showing Location of I Beams

Ends of Trusses 11 & 12



Attachment of Shafting Standard Showing Cast Washer

Three narrow gauge tracks run through the shop, connecting at either end with transfer tables which are placed just outside, and enable any car to be run in on any track, there being tracks outside the building also, on which material may be transferred in either direction, and to any part of the works.

At each tool in the main shop there are two incandescent lamps; general illumination being secured by arc lamps, of which there are ten, distributed throughout the building overhead, and supplied from the same circuit as that which supplies the incandescent lamps.

In summer time the building can be thrown open entirely all around, nothing but the posts remaining to obstruct the free passage of air through it, and men can thus work under the most comfortable conditions possible, while in winter it is closed up, heated, and at the same time ventilated by the Sturtevant hot blast system.

The plant is a most interesting one to visit, and very instructive as well to him who wishes to study the subject of true economy in shop construction.

Some one—we do not know who—once said: "It is all right to advise a man to turn a thing over in his mind before acting, if his mind is bigger than the thing to be turned over." This is pretty sound advice. It might have been added: "If his mind is not big enough for the purpose, then get some one else to turn it over for him."

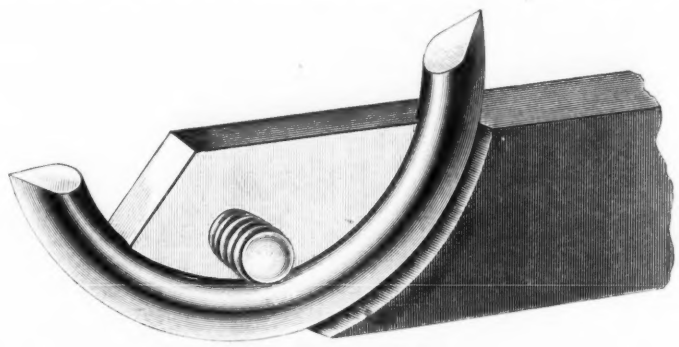
Cheap Machinery.

Our correspondent, W. H. Booth, in his communication printed in last week's issue on the subject of "Cheap Machinery," brings up a question in relation to such machinery which has puzzled many others besides himself, until they have taken the trouble to look into the matter, and see just why it is that cheap machinery is so apt to violate all the principles of machine design, as well as to show inferior workmanship. It is very likely to be the case that, when a man decides to bring out a cheap machine, the first thing he does is to look for the cheapest man he can find to design it, and the work this man does is quite likely to be in accordance with the price paid him for the work. Part of the price paid for good, first-class machinery is for its designing, which has cost money and must be paid for by some one, since good designers of machinery do not work for nothing. Of course we all know that, even when a cheap machine is to be built, it pays to have it well designed, and that, in fact, a skilled designer who has the object of cheapness before him in designing a machine can often so arrange things that the machine can be manufactured cheaply, and, at the same time, be a fairly good machine. But the employer who understands this fact, and the philosophy of it, usually understands enough of the business to make him wish to build a machine at least as good as any other of its class, and, consequently, the "cheap and nasty" designing is usually found in company with the "cheap and nasty" workmanship, both coming from establishments where little or nothing is known or cared for either good designing or good workmanship. It seems to any one who knows anything of the subject, that the matter of making rounded external and internal corners in castings, alluded to by Mr. Booth, should be very simple and easily understood by any one possessing even an elementary knowledge of machine design. That it is not universally understood by those who make machinery is proven by the continued appearance of machinery with sharp corners on the castings. A man who has gone even so far as to become acquainted with the philosophy of round corners has commenced to study the science of machine design, and has already gone too far in this to be available for some of those who are building cheap machinery and are always looking for the cheapest men to do the work on it. The fact is, that much of such machinery is built without drawings, the designing, such as it is, being done by the cheap pattern makers, cheap blacksmiths, and cheap machinists as they go along with their work, each mechanic making each piece according to his individual ideas at the time, without much regard to the work of his colleagues, the machine, when it is finished, looking just about as one would expect it to look when made in such a way.

A New Threading Tool.

In our issue of Aug. 14, '90, we illustrated a new lathe tool made by Berger Brothers, of 240 Plymouth street, Brooklyn, N. Y., which, since that time, has come into quite general use, and has caused a demand for a threading tool made on the same principle; a demand which the tool illustrated by the accompanying engraving is designed to supply. The cutters are made of the finest steel, and are ground to the correct angle after being hardened so that no gauging is required, and it is only necessary to grind off the top faces of the cutters, each end being available for this purpose. The cutter is, of course, very firmly held, and forging, tempering, and most of the labor of grinding are done away with. Cutters are 60° angle and either U. S. Standard or sharp V, as may be desired. It will be understood, of course, that the cut shows the tool with the clamping plate removed.

They are made in three sizes—½″x1″; ⅝″x1″; and ¾″x1¼″.



A NEW THREADING TOOL.

A Composite Gear.

The engraving shown herewith represents the construction of a gear designed to be noiseless in ordinary operation, and yet to have the quality necessary for hard driving when circumstances call for it. In the construction of this gear the effort is to preserve the noiselessness of the contact of leather or rawhide, and at the same time to furnish a "backing" that shall sustain the strain of incidental hard work that the gear may be subjected to.

Noiselessness and durability do not seem to harmonize, yet it is often desirable to combine these two conditions, so far as practicable. This has been the effort in the construction of the gear which we show.

As shown by the engraving, this gear is composed of a series of steel plates alternating with a series of rawhide plates, the whole held between heavy steel end plates by rivets. The plates are compressed so that the rawhide is condensed, requiring an enormous pressure. The rivets are headed up hot, and then the blank so formed is bored, turned to size, splined and cut the same as an ordinary solid blank would be. The process is laborious and complicated, but when special tools are used the resulting blank can be made quite as cheaply as the more simple solid rawhide blank.

It is seen that by this disposition each plate of rawhide, while it must stand out from the steel a little, and form the cushion to take the actual contact, is so supported by steel plates on either side, that, when it is forced back by heavy pressure, it cannot be forced back far enough to damage it. When the pressure is light the rawhide is in contact, but when the force is too great for its strength it retires and the steel stands up to the work. The result is that, although durability is not perfect, and noiselessness under heavy pressure is not perfect, the two are combined so far as two contradictory features can be combined, and the composite pinion is as noiseless as can be expected with due regard to strength.

When the rawhide is worn away it is a simple matter, when provided with proper tools, to insert new plates and restore the pinion to its full efficiency.

This gear is manufactured by the Lexington Gear Works, 140 Fletcher street, Lexington, Mass.

A COMPOSITE GEAR.

Success with Nickel Alloy.

Last week there was turned out of the open hearth department of Carnegie, Phipps & Co., Pittsburgh, Pa., a nickel steel ingot weighing over 25 tons. It took the entire contents of one open hearth melting furnace to make the cast, and the ingot, when scraped, was found to be a perfect cast, and absolutely without a flaw. It is to be reheated and then rolled into an armor plate for the United States monitor Monterey, now in course of construction. This is the largest steel ingot yet made in any steel-mill in this country. After having experienced success with this one, the Carnegie works will next cast a nickel steel ingot weighing 50 tons.—*Stoves and Hardware Reporter.*

LETTERS FROM PRACTICAL MEN.

Cupola Construction.

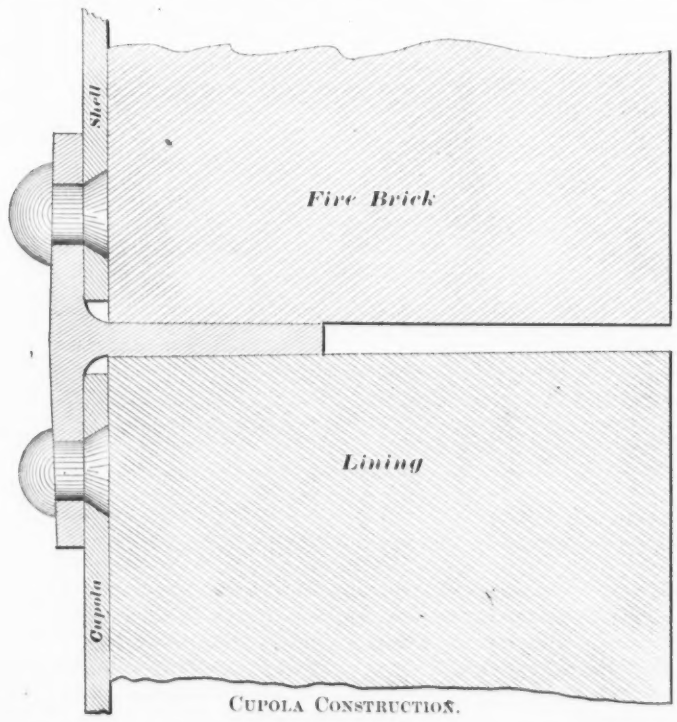
Editor American Machinist:

Lining a cupola with fire-brick would not be half the job it usually is if it were not for the cutting of the fire-brick to fit around tuyeres, joints in the shell, rivets, and the angle-iron bands put in to sustain the upper section of the lining.

Whether these difficulties trouble people using large cupolas, and where a stock of special brick are kept, I do not know, but with us when the whole lining has to be cut out of cupola and arch brick, the cutting is half the job.

One way out of a good part of this trouble would be to construct the shell as shown by the sketch, making all the rings of the same size with T-iron for joint covers, the foot projecting in to support the upper lining. This being thin, and riveted with counter-sunk rivets, would call for no cutting of bricks other than around the tuyeres. Ordinary T-iron is not exactly what would fit best, but Carnegie 366 will do this without special rolling.

It is not very probable that this is new; it looks feasible, and ought to do. J. E. S.



CUPOLA CONSTRUCTION.

About Steel.

Editor American Machinist:

A great deal has appeared from time to time in the columns of your paper and other mechanical journals relating to the treatment of steel. In a majority of cases the subject has been treated as though the word steel had a fixed and universal significance to all mechanics, and needed no qualification whatever, no matter what the make or grade, or for what purpose to be used. Now it seems to me that a short but comprehensive treatise might be written upon this subject by some of your correspondents who are thoroughly acquainted with the manufacture and use of steel, dividing it into as many classes as seems advisable to them, and by the best method suggesting itself (classifying it according to the different prices. This would be a great deal better than calling it simply steel). Then classify the different uses to which steel is applied in every-day machine shop practice and give the most approved method of handling the steel in the different processes of annealing, hardening and tempering, and state what grades are best adapted to different uses from both the mechanical and commercial points of view.

An article of this character, carefully written by one who *really knows*, would be invaluable to the young mechanic, and perhaps to a great many who are not so very young, for there is probably no branch of the trade which has been so shrouded in mystery as the "art" of annealing, hardening and tempering steel.

In your issue of October 8, 1891, S. W. Goodyear says, "The steel itself will, if listened to, tell us what is necessary, etc."

Now this is very good for those who understand the language of steel, but there are so many of us with such abnormally long ears, that the remarks of the steel become distorted before reaching the seat of intellect, to such an extent that, when a piece of steel says to us, "Heat me a uniform cherry red and I shall be at my best," we understand it to say, "Heat me a *'nice lemon yellow,'* and you will have no trouble." Then when the outraged steel kicks by refusing to harden, or by going out of shape, we say that it "was a very poor piece of steel," or if it is a forging, we say, "I guess that was burnt by the blacksmith." Perhaps some of your readers will remember of having heard these remarks.

Mr. Goodyear's article is an exception to the general rule upon this subject, and I heartily agree with the most of his "donts," except in the case of removing articles from the cooling bath and warming them over the fire. I have no doubt that this might be practiced successfully with some kinds of steel, upon some kinds of articles, and here is where the error of generalizing comes in again. For with some other steels, and upon some other articles, I don't think it would be the correct thing at all, but would result in nearly as large a percentage of loss as he speaks of.

But for any one who is losing such a percentage, or even ten per cent. of articles tempered, I should advise that he try this, or almost any other method, lest his employer advise him to try some other shop.

I do not understand that by warming the outside of a piece before it is cool inside, the antagonistic strains spoken of are removed, but I do see that the outside might be toughened by heat to withstand them, and I think there can be no question but that the piece would be hard outside and soft within; practically case-hardened, the thickness of the casing depending upon the size of the piece, and the time it was allowed to remain in the bath.

My opinion upon this subject is that, after an article has been heated *evenly* to the proper degree of heat required by the grade of steel of which it is made, it should be quenched as *evenly* and as *quickly* as possible. I assume that if each and every particle composing a piece of steel could be heated to exactly the same temperature, and exposed at the same instant to the same cooling influence, there would be no variation in the expansion and contraction during the operation, and consequently no inclination to conflicting strains. Acting from this course of reasoning I use plenty of running water for quenching articles of any considerable size, allowing it to run freely through openings if there chance to be such in the piece, thus conducting away the heat as rapidly as possible. J. N. SEVERANCE.

That Rusty Grindstone.

Editor American Machinist:

Some time ago some one asked for information in regard to his grindstone, which became rusty and refused to cut hard steel. I have a small stone that acts the same way, and my remedy is to turn it off slightly with a piece of soft iron; a piece of ⅜″ rod answers very well, using plenty of water. I have a "kink" for this. Instead of holding the rod at right angles to the axis of stone, I incline the free end in the direction I wish to move it, and roll it on the rest block; this feeds the rod in as fast as it is ground off, and prevents jabbing holes in the face of the stone. I have noticed that when an emery wheel used for grinding hard steel becomes dull, grinding a piece of cast-iron on it will cause it to again cut the hard steel freely. W. L. HARDY.

The Proposed Change by the American Society of Mechanical Engineers.

Editor American Machinist:

As the American Society of Mechanical Engineers was initiated in your office, and as you have always taken a great interest in its progress, I am tempted to ask for a little space in your columns to express my views in regard to the recent circular of the society, calling attention to certain proposed amendments relating to dues or assessments.

I have answered the circular, expressing my opposition to the second question, increasing the annual dues from $10 to $15, and indifference to the other two questions.

This matter of the increase of dues was brought up at a meeting in New York some years since, when we had about 350 members, and I opposed it then, on the ground that, with proper exertion, the membership might be brought up to 1,000, and the revenue to $10,000 per annum, which seemed

to me to be ample. This has already been done, and judging from the ballot sheets sent me this year the increase is as rapid as ever.

The increase of $5 may seem to be a small sum, and it is so to those who have a lucrative and constant practice, or a rich wife, or other independent means of income, but it is an onerous tax on the younger members of the profession who are not in regular, active business.

The cost of attending even one annual meeting, to members not residing in New York or Philadelphia, or the immediate vicinity, is from $20 to $40, and the extra assessment *counts*. The use of the rooms of the society is also practically confined to a very small fraction of the members. I have been in New York once since the new house was opened, and spent the evening there, meeting only *one* other member of the society, who, like myself, was only passing through the city.

The main point, however, to which I wish to call attention is the argument founded on the cost of publication, and here I am decided in my opinion that such cost should be reduced to something near the earlier custom.

Volumes of from 1,000 to 1,200 pages are unnecessary and superfluous, and contain much matter of no especial value. In a recent volume, fifty pages were devoted to a single North River ferryboat, and we have had two papers on "Profit-sharing," a purely commercial question, involving neither mechanics or engineering, and as inappropriate to the transactions of our society as papers on Pork-packing, or Cotton growing would be.

Many of the papers are filled with long and elaborate mathematical calculations of a kind which no one but a "professor" reads after he has left school, and which few have the patience to follow, doubting if the kernel to be discovered will pay for the labor of cracking the nut. The opening and closing paragraphs of the preface to the late John C. Trautwine's Engineers' Pocket-book expresses my opinion on such papers better than I can myself. When I was at school—from 1836 to '40—I went as far into the higher mathematics as I could find text-books to carry me, and enjoyed making figures "for the fun of it," such as "squaring the circle," and seeing how far I could extend the 3 1416 of ordinary practice, but active business life long since drove the taste, and the facility of using it, clean out of my head.

In conclusion, my advice to the officers of the society is to restrict the expenditures of the society to the income derived from present dues, to reduce the annual Volume of Transactions to 500 or 600 pages, and to confine it to such papers as are of actual practical value, and not make it a receptacle for the lectures or graduating theses of any academy, and I trust a sufficient number of my fellow members will agree with me, to vote down the proposed amendments.

SAMUEL WEBBER.

Night Work.

Editor American Machinist:

With reference to Mr. Halsey's question on the above subject:

To charge the customer with the rate for the machine according to the number of hours allowed on the workman's time card, which, of course, includes the time allowance for such overwork, places an unearned addition to the bill equal to the number of allowed hours multiplied by the difference between the rate of the machine and the rate of the man per hour. And to charge the actual hours worked at the rate of the machine is to reduce the bill at the cost of the owner of the works, consequently both methods are unjust. Let us examine the subject, and we may arrive at a fair conclusion as to the course to pursue.

In a machine shop the rate per hour for a machine should include such items as the wages paid, interest on total cost of the machine, and a sufficient margin to cover share of rent of property, space, heat, light, power, wear and repair, running and general expenses, and the profit to the owner.

And the engine and boiler, with which, in this case, we may include the shafting, also has a value per hour, the rate of which can be figured by the actual expenses, and the proper share of all general expenses. And while under ordinary circumstances, as in day time, the value per hour for motive power is contributed proportionately from the earnings of all the machines, and enters into the estimation of the rate per hour per machine, still, at night, the engine may be run for perhaps one machine, and although the engine may be out of all proportion to the work done, there can be no doubt about charging the cost of the power to the work that makes it necessary. It might be said that since machine shops usually figure on making their expenses by day work, that night work should be free from the margin of cost to defray general expenses, and while this may be logically true, the experience of managers is to the effect that night work frequently entails extra cost in its prosecution, and that the margin saved on the one hand disappears in expense on the other is also true.

We can assume that the machine is valued at 50 cents per hour, of which the workman receives 25 cents. And that the engine, boiler and shafting are valued at $1 per hour. Also that the extra light, and other special requirements, may be sufficiently approximated by experience and judgment. And as for the owner's or foreman's time, if such is necessary, charge according to the service rendered.

We can now make out a bill of cost for 10 hours overtime, the workman receiving "time-and-a-half."

10 hours night work at 50c. per hour	$5 00
5 hours extra time to workman at 25c. p hr	1.25
10 hours running engine at $1 per hour...	10.00
Superintendent's services—whatever it may be.	
Light, and other extra charges "	"

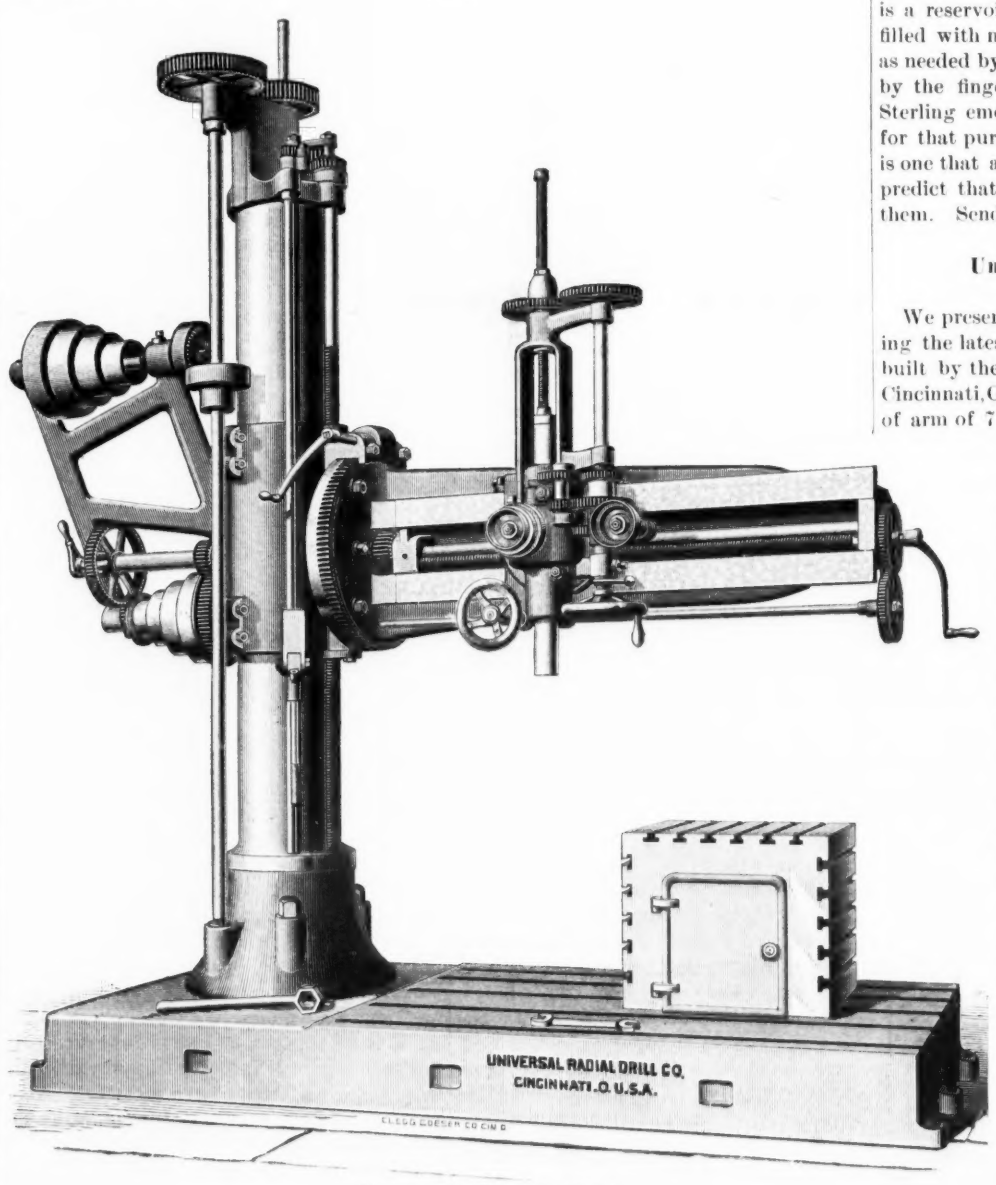
Chicago, Ill. G. WELSBY SCOTT.

A New Adjustable Level.

The accompanying engraving shows a level which is being made by Mr. C. F. Richardson, of Athol, Mass. It is intended for those whose work requires a more accurate instrument than the ordinary level, and the glass is ground inside and has graduations upon it the same as are used upon the better class of engineers' instruments. It is made of brass, with the tube nickel-plated, and base japaned or nickeled.

A NEW ADJUSTABLE LEVEL.

An adjustment is provided by which the level may be accurately adjusted parallel with the base by reversal, and after being once adjusted its construction is such that it is not liable to be disturbed. They are made in three sizes—4", 6", and 8" long.



UNIVERSAL RADIAL DRILL.

A Wonderful Mineral Substance.

A new mineral substance, resembling asphalt, has been discovered in Texas, which promises to become very useful to the scientific and industrial world. It is unaffected by heat, acid or alkalies, and is said to be the most perfect insulator yet discovered. It may be used for paint, and is a perfect covering for wood or iron, resisting all the influences which destroy ordinary paints. As a varnish it retains its character under all conditions. It may be rolled into a tissue and used for water-proof tents, clothing, etc.; it makes leather impervious to water, and prevents iron and steel from rusting.

Prof. Hamilton, of the Western Electric Company, finds that wires covered with this substance offer sevenfold the resistance offered by other wires, and the results of its use in electrical engineering are likely to be very marked. The material is found in unlimited quantities, from two to forty feet below the surface, and, if it proves as useful as it promises, will be a new source of wealth to Texas.—*Boston Transcript.*

There has been a large increase of the number of scholars in the schools of England since September 1, when the free education act went into force. The managers of schools advised the parents of the scholars to put into savings banks; for the benefit of their children, the three pence per week that had previously been paid for the education of each child, and school savings banks were established to receive these deposits. This advice was followed by large numbers of parents in various parts of England, and the banks have already been of service. In the city of Manchester, for example, more than 5,000 new accounts have been opened in them the first month. The small funds thus deposited will be useful to the children hereafter.—*London Letter.*

The latest thing in the way of a match safe (and advertising scheme) is being distributed by the Sterling Emery Wheel Company, of 174 Fulton street, this city. There is a reservoir at the back, which is to be filled with matches, which then come down as needed by gravity, and can be taken out by the fingers and scratched on a 3"x¼" Sterling emery wheel fastened to the safe for that purpose. The whole arrangement is one that appeals to a mechanic, and we predict that it will prove popular among them. Send for one.

Universal Radial Drill.

We present with this an engraving showing the latest form in which radial drills are built by the Universal Radial Drill Co., of Cincinnati, Ohio. The drill shown has a length of arm of 7 feet 6 inches, and will drill to the center of a circle 12 feet 2 inches in diameter. In addition to the other features of this machine, which have been previously explained in our columns, and which will be recalled by an inspection of the engraving, provision is made for moving the saddle on the arm either from the end of the arm or by a hand-wheel on the saddle itself; the latter being connected by bevel gears to the splined shaft which runs along under the arm, and by spur gears is connected to the traversing screw. The diameter of the column is 15"; height, 10 feet; height of machine over all, including the countershaft, 14 feet; greatest distance from bed-plate to end of spindle, 7 feet 5 inches; size of table, 28" x28"x28"; diameter of spindle, 3½"; traverse of spindle, 28"; floor space for base, 120"x60"; weight, about 15,000 pounds.

According to *Invention*, peat has been adopted permanently as fuel for the locomotives upon the Vadstena-Oderhogs Railway in Sweden, after a series of exhaustive tests to determine its relative power and cost as compared with coal. In the final tests, a locomotive pulled a train of ten carriages at regulation speed, and up the steepest gradients. Steam was maintained easily at full pressure, even when cold water was fed into the boiler. The experiment was so satisfactory in every respect, that the directors resolved to use no more coal so long as the requisite supply of peat can be procured.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

NEW YORK, NOVEMBER 5, 1891.

CONTENTS.

PAGE.

A New Screw Machine 1
A Correction..... 1
The Superiority of Independent Condensers for Marine Engines on the Lakes. By J. F. Holloway..... 1, 2
Prof. Sweet's Ideas Tested. By Albert F. Zahm 2, 3
Improved Automatic Bolt Cutter..... 3
Boring and Turning Mill 3
Narrow Gauge Railways in France..... 3
Japanese Copper Mines 3
New Works of the Berlin Iron Bridge Company..... 4, 5
Cheap Machinery..... 5
A New Threading Tool 6
A Composite Gear 6
Success with Nickel Alloy..... 6
Letters from Practical Men: Cupola Construction. By J. E. S....About Steel. By J. N. Severance ...That Rusty Grindstone. By W. L. Hardy....The Proposed Change by the American Society of Mechanical Engineers. By Samuel Webber....Night Work. By G. Welsby Scott 6, 7
A New Adjustable Level 7
A Wonderful Mineral Substance..... 7
Universal Radial Drill. 7
The Mechanical Engineers' Society..... 8
Literary Notes..... 8, 9
Questions and Answers..... 9
Manufactures..... 9, 10
On the Cultivation of Inventive Capacity. By Leicester Allen..... 11
Machinists' Supplies and Iron..... 11

The Mechanical Engineers' Society.

It is evident, from what has been announced to members concerning the annual meeting of the American Society of Mechanical Engineers, to be held in this city November 16 to 20, that it will be a meeting of unusual interest and importance to the society. A number of questions of importance will be acted upon, including the propositions to increase the initiation fees and dues, and to so change the rules as to require the nominating committee to nominate two candidates for each office to be filled, instead of only one, as at present.

Both these proposed changes, we think, are in the right direction. The nominating committee was originally intended to be, and undoubtedly should be, nothing more than a nominating committee, but when it puts only one member in nomination for an office, it practically elects that member to that office, and the bother and expense involved in obtaining a vote of the members upon the election might just as well be dispensed with. But believing, as we do, that the members should have a voice in deciding who shall be the officers of the society, we believe that at least two candidates should be put in nomination for each elective office, and that members should then be asked to decide between them by ballot.

As to the increase in initiation fees and yearly dues, we think that an examination of the matter will convince most members that this is almost a necessity, and that it certainly is a necessity if the society is to occupy the place which it should occupy as representing the profession of mechanical engineering in this country. The manner in which the affairs of the society have been conducted in the past has been very creditable to it, and to its members, comparing very favorably in this respect with other engineering societies, in which the expenses of members are considerably greater, but this has been done by expending all the money received in initiation fees and dues, with some additional, which has been voluntarily contributed by a few members. Any engineer worthy of the name knows that this should not continue; either the income should increase in some way, or expenses should be cut down to somewhat less than the income. It is not in keeping with the dignity of such a society to ask for voluntary contributions to defray its running expenses, and, moreover, no such society can afford to give to certain of its members a possible ground for assuming that they should have more to say regarding the affairs of the society, than others who have not contributed so much money to its support. True we have never noticed the least tendency to an assumption of this kind, but difficulties have arisen in other societies from this cause, and, to avoid the possibility of it, every member of the society should stand upon precisely the same footing in this regard.

The publications of the society are recognized the world over as being of a very high order. They not only reflect credit upon every member of the society, but they should be, and probably are, worth more to the members than the yearly dues amount to.

Books similar to the volumes of transactions of the society, containing similar matter, printed, illustrated and bound in the same way, would, if issued by regular scientific book publishers, cost more than $10, as any one will readily be convinced who compares these volumes with books published in the regular way, and sold at $10 per copy. The expense of publishing such books for the limited number of readers they find is very heavy, as compared with books of the ordinary kinds, and any one conversant with the matter knows that $10 is a low price for them.

Few members of the society, we think, would be satisfied to have it go backward in respect to the character of its publications, or in any other respect, and there remains, therefore, only one alternative, which is to increase the initiation fees and dues to something like what they are in other similar societies, and to what membership in this one is really worth to most mechanical engineers.

Of course, it is not to be expected that every member will view these matters in precisely the same way. A well-known and respected member gives his views upon them in a letter published elsewhere in this issue, which was received after the above was written. It may be well to briefly refer to the points made by Mr. Webber. As to the increase of revenue derived from increased membership, not much can be hoped for from this, so long as the current expense per member practically equals or exceeds the dues. As to the house of the society, and its usefulness to those members only who reside in New York or vicinity; it is obvious that the society must have somewhere a home or headquarters, where its library and other belongings can be kept, and where its regular business can be transacted. This being the case, the question of its location comes up, and it would seem as though the city of New York was the best place for this, for the same reason that London is considered to be the best place for the headquarters of the British scientific societies, among these reasons being the one which perhaps has more weight than any other, *i. e.*, that more members are drawn to the chief city of a country, by various business and social matters, than are drawn to any other one city.

While the location here gives members resident here or in this vicinity some advantages, it also imposes some burdens upon them, not felt by other members, among which may be memtioned the expense connected with the annual meeting, which, with one exception, has been held in New York, and probably will be regularly held here.

The volumes of the transactions are, and evidently must be just what they purport to be, *i. e.*, a complete record of what takes place at the meetings, and the only way in which the volumes can be made to contain less matter is to have less matter presented before the society. It should be remembered here that the society contains among its membership, engineers who are engaged in all the various branches of mechanical engineering, and that it is not to be expected that every member will be equally interested in every paper.

There are members who are especially interested in marine architecture and engineering, who would like to see even more matter relating to that subject, while they might be very little interested in the subject of the measurement of power, or the testing of water wheels, subjects to which we dare say Mr. Webber would be willing to see considerable space devoted, for the reason that his work has been in this direction, and he is specially interested in it, as he should be, of course.

A very large proportion of the members of the society are managers of shops, and are vitally interested in anything which pertains to shop management. The papers on profit sharing and premiums relate directly to shop management, and the interest taken by the members in those papers, and their appropriateness to the objects of the society, would seem to be proven by the discussion of them. We do not wish to appear dogmatic in this matter, and we hope that action finally taken will meet the approval of a very large majority of the members. We agree beforehand to cheerfully acquiesce in their decision.

It is announced that some changes have been made in the usual arrangement of the program for the week, and it is proposed to have two afternoons set apart, during which there will be nothing to interfere with members attending to any private or professional business which they may wish to transact in the city. These two afternoons (Tuesday and Thursday) may be utilized in any way that members may see fit, and will give an opportunity to attend to affairs which it is found that almost all attending members have to give attention to when coming to the city, most of them arranging to attend to more or less business while here. At the same time excursions to various points of interest will be organized on those afternoons for those who, having no affairs of their own to attend to, may prefer to spend the time in that way.

Sixty-two names are proposed for full membership for this meeting, eight of these being for promotion of juniors, while twenty-seven are proposed as junior members.

The modern newspaper, made up in sections that fall in pieces when you want to read it in the cars or while crossing the ferry, is one of the worst mechanical monstrosities of the day. Modern science ought to contrive some way of gluing the component sections together so that the reader does not have to look all over the train or boat for the parcels he has bought.

The Society of American Wood Engravers of New York City has been awarded the grand diploma of honor by the committee of the Berlin International Exhibition of Fine Arts.

Literary Notes.

A TEXT-BOOK OF MECHANICAL DRAWING. Part I: Use of Instruments and Geometrical Problems. Part II: Orthographic Projection. By Gardner C. Anthony, A. M., Member of American Society of Mechanical Engineers; Director of Rhode Island Technical Drawing School.

These parts are intended for a text-book on mechanical drawing, suitable for the use of high schools, evening, drawing, and technical schools. Although the work is not intended as a substitute for, but as a supplement to, the work of a teacher, we believe it can be advantageously used for home practice by any one desirous of obtaining a knowledge of the elementary principles of mechanical drawing. All the problems and solutions are stated very clearly and concisely; the illustrations are very good, the whole forming an excellent little book, well adapted to the purpose for which it is intended. It is used with success in the Rhode Island Technical Drawing School in the city of Providence. The price of the book is not given.

In connection with this, it may be said that the above institution was established in 1887, for the purpose of giving courses of instruction in engineering and architecture. We understand that the course extends over ten months only, furnishing a practical technical training to its students sufficient to give them a fair start in their professions. In so short a course, much of the technical education given in a four years college course has to be omitted, which, although very desirable and necessary as the student advances in his profession, is not always absolutely necessary in the beginning. This institution has day and evening classes, and special advanced classes. It now enters on its fifth year, with increased facilities, which its success and popularity demanded.

COMMON SENSE IN MAKING AND USING STEAM. Facts for the consideration of Proprietors of Steam Plants. By One who has paid for his experience.

The author of this excellent little book gives the results of his experience and observation in the line of steam engineering during a practice of more than thirty years, in which he has visited hundreds of steam plants in different parts of the country, and made numerous tests of boilers, engines and other steam appliances. He presents facts, data, and his conclusions, in a clear, simple and interesting style, conveying much useful information to persons contemplating the erection of steam plants, and also to those who have the management of boilers, engines and steam appliances. The book treats on the location of steam plants, arrangement of its parts, boilers, furnaces and fuels, feed water and apparatus, boiler compounds, skimmers and automatic attachments, engines, lubricants and lubricators, duty of engineers and firemen, convenient rules, tables and facts, and concludes with brief items of useful information. The book contains 53 pages of useful reading matter, a complete index, and no advertisements. It is the second in a series which the Mason Regulator Co. intend to publish on different subjects, and of which the

"Key to Steam Enngieering," previously noticed in these columns, was the first one. It should have a large sale, and be in the hands of every one who has charge of or who owns a steam plant, and those seeking information and facts relating to making and using steam. The book is published by the Mason Regulator Co, manufacturers of steam-regulating specialties, 10 Central street, Boston, Mass. The price of the book is 25 cents, postpaid.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(476) J. E. S., ——, asks: Is it possible to set the valves of a locomotive square at all points of cut-off, forward or backward, with the saddle pin in the center of the link? *A.*—No.

(477) A. B., Birmingham, Ala., writes: Kindly inform me how or where I can procure an article, like cloth, for instance, or something equally pliable, that could be worked up into small articles requiring immersion in water, but, upon removing, water should not adhere to it. *A.*—It seems to us that sheet rubber could be prepared to answer your purpose. Write to any manufacturer of rubber goods.

(478) G. W. M., Stroudsburg, Pa., writes: Kindly give in your paper an answer to the following: How much water will flow through a six-inch pipe per minute, a distance of three miles, with a fall of 200 feet? This question is at present agitating our community, and I would like to have a correct solution from an authority. *A.*—If the total head is 200 feet, the discharge per minute will be about 49 cubic feet.

(479) W. S. G., La Grange, Cal., writes: Please inform me of the cheapest book-store where I can purchase works treating on scientific and mechanical matters. Should you deal in this class of books, I shall buy them of you. But I am a young man in poor circumstances, and I desire to buy where I can get the books the cheapest. *A.*—We do not deal in any kind of books. All standard works are sold at a regular price, and in dealing with first-class houses you will get them as cheap in one as in another. It is possible that you may find the books in second-hand stores, and in these the prices may vary. Our advice to you is, look around.

(480) J. R. B., Brooklyn, N. Y., writes: I have started designing yachts for pleasure, but got stuck in some of the calculations, such as computing areas of water line planes, center of gravity, buoyancy, etc. Please recommend a work for me to study to get over these kinks, especially in arithmetic, algebra, etc. I have read your article in your issue of February 19, "What to Study and how to Study," with great interest and benefit. *A.*—To overcome any difficulties in arithmetic, study any good school arithmetic; for algebra, we have already mentioned one in the article you refer to. For overcoming kinks in yacht designing, use Peake's Naval Architecture (Weale's series).

(481) A. E. R., Syracuse, N. Y., writes: Please decide who is correct concerning the following question. It is claimed that any shaft, arbor, etc., once trued up, then turned, and afterwards splined, will not change. I claim from practical experience it will change; that is, run out of true. The piece should be roughed off, then splined, or the keyway cut and fitted, so that, while taking the finishing cut, the calipers or gauge will pass over spline without catching. Am I correct? *A.*—Yes; cutting a keyway in a shaft, etc., is liable to throw it out of true. In regard to the other matter mentioned, we shall be pleased to hear from you; if the subject is of sufficient importance to our readers, we will publish it.

(482) H. H. W., Albany, N. Y., writes: I have in my possession a volume of the AMERICAN MACHINIST for the year 1890. In it I found a series of papers on the subject of force, signed by Pedro. They interested me greatly, as I have just taken up the subject of mechanical engineering, which I mean to make my profession, having recently graduated from school. There was, however, one serious drawback, the articles were not complete, I lacked 7 numbers. Please inform me in what volume and number these 7 papers may be found. *A.*—September 19; October 3, 10, 17, 31; November 21; December 5, 1889. 2. I would also like to know if there have appeared in your issues any other papers on elementary mechanics, and if so, in what numbers? *A.*—See Stress in Structures, April 10, May 15, June 19, July 31, 1890, and January 22, current volume.

(483) J. H., Buffalo City, Wis., writes: Kindly reply through your columns to the following: In a water tube boiler, about what would be the relative evaporative capacity of tubes .07 of an inch thick, as compared with tubes .15 of an inch in thickness? *A.*—The difference is inappreciable; for all practical purposes we may assume that the thickness of the plate or tube has no appreciable effect on the rate of conduction through it. 2. What is the approximate difference in time required to raise steam from cold water, all other conditions being the same? *A.*—Since the difference in the thickness of the tubes is only a small fraction of an inch, the difference in time to raise the steam will also be very small. It is almost impossible to compute the time with any degree of exactness. If this difference in time of raising steam is of any great importance to you, the safest way to determine it will be by experiment.

(484) A. R., Philadelphia, Pa., writes: I had an argument with a fellow workman in regard to the length of time water could be used in a boiler without drawing any out of the tanks. He said that an engineer told him that the boilers were filled at port and lasted through a run of fifteen days without drawing water from the tanks. I asked another workman, and he said the water would last from three to four hours. I thought it was a big jump from fifteen days to four hours. Please state the average time that steamships can run without taking a fresh supply of feed water, and how much water they carry with them. *A.*—If the boilers are filled with pure water at the start, and supply steam to a first-class surface-condensing engine, no fresh supply of feed water is needed during a voyage, excepting the small amount necessary to make up the loss due to leakage and waste of steam, because in this class of engines the steam, after it has done its work, is condensed and fed back into the boiler; and if there is no leakage or other waste or use of steam there would be no fresh supply of feed water needed. For jet-condensing engines, or non-condensing engines, a fresh supply of feed water is required as soon as the engine commences to do its duty; and the amount will depend on the power of the engine. Steamships do not generally carry a supply of feed water; any loss is made up by salt water. Tugboats, ferryboats, and others making short runs in salt water sometimes carry a supply of fresh water to be used for feeding the boilers, and the amount carried will depend upon the distance between water stations, and the power of the engine.

(485) G. J., Harriman, Tenn, writes: We have trouble with water flying from one boiler to another until there are three full gauges in one, and no signs of any water in the other boiler; and in a few seconds the reverse will take place. I therefore deemed it necessary to shut down, and seek a remedy. I had a hole cut in the top of each boiler, and connected them by a 2-inch pipe. This had an effect, but it did not wholly cure the trouble; the water regulates itself for a whole day, and probably the next day will give trouble for half an hour at a time. We have six boilers; one is separate from the others, and the remainder form two batteries, two boilers to one battery, and three to the other. I have an equalizing pipe 3 inches diameter on the three boilers. The single boiler is of the tubular type, with 48 tubes 4 inches diameter; the shell is 54 inches diameter and 15 feet long; dome, 26 inches diameter and 26 inches high; feed pipe, 2 inches diameter connected to the bottom of the boiler. The boilers in the battery of two are precisely the same as the single boiler, with this exception: each of the two boilers has a mud drum 24 inches diameter, 13 feet 6 inches long, connected to boilers with two 10-inch nozzles. The safety valves are placed on top of domes with connections 4 inches in diameter to main steam pipe. The width of grate is 10 feet 6 inches, and 6 feet long; height from grate bars to bottom of boilers, 28 inches. The boilers are fed with the Rue injector; gauge pressure, 85 pounds. The boilers in the battery of three are 48 inches diameter, 20 feet long, each containing four flues; two are 12 inches diameter, and the others 9 inches. Mud drums 18 inches diameter, 16 feet 6 inches long. These boilers have no domes; they are connected by 3-inch pipes to main steam pipe. The main steam pipe is 50 feet long, 8 inches diameter; near the end of this pipe there are two 6-inch pipes leading to engines. One of these pipes supplies steam to one 24x36 inch engine running at fifty revolutions per minute; one 13x20 inches, 50 revolutions; and one 9x12 inches, 150 revolutions. The other steam pipe supplies steam to one engine 20x36 inches, 80 revolutions; one 14x36 inches, 90 revolutions; one 6x12 inches, and one 5x10 inches, each making 70 revolutions per minute. Do you think I can remedy the trouble by using a 12-inch pipe instead of the 8-inch, and leading from this main pipe two 8 inch pipes into the factory, all the other pipes to remain unchanged? *A.*—Your main pipe is too small in diameter for supplying steam to all the engines mentioned, and, doubtless, increasing its diameter will have a beneficial effect. But we believe that the principal cause of the trouble is in the feed pipe connections, of which you have said nothing. If each boiler is fed separately by an injector it will be difficult to maintain the same water level in all the boilers of one battery. They should be connected by one feed pipe with a check valve on each boiler; then, with careful firing, you should have no trouble.

(486) E. L. M., Ridgway, Pa., writes: I desire some information about springs in regard to calculating the safe load and resistance with a certain number of pounds. I mean such springs as would be used in a shaft governor for automatic engines. I have searched a number of books on engine design, but have failed to find anything in regard to what I want. Kindly furnish me rules that can be worked out in plain mathematics. Perhaps you know of some book that treats on this subject. *A.*—We have not seen an extensive treatment of this subject in any book, and the results obtained by the rules do not always agree with practice; hence these results should be considered as approximations, which should be modified as dictated by experience. The article on spiral springs, in our issue of January 7, 1888, is probably the best that has been published on this subject. We have also given two formulas in answer to Question 252, in our issue of June 4, current volume. To this we may add another:

$$E = \frac{d^3 \times w}{D^4 \times C}$$

in which E denotes the extension or compression of one coil in inches, and C a constant equal to 22 for round steel, and 30 for square steel; the other notations are the same as given in answer to Question 252. These formulas have been taken from D. K. Clark's Manual of Rules, Tables and Data for Mechanical Engineers. In Rankine's Machinery and Millwork, we find the following:

$$\frac{W}{v} = \frac{c\,d^4}{64\,n\,r^3},$$

$$W_1 = \frac{.196\,f\,d^3}{r},$$

$$e_1 = \frac{12.566\,n\,f\,r^2}{c\,d},$$

and $\frac{W}{2}$ = greatest safe sudden load.

In which d denotes the diameter of wire in inches; c a coefficient of transverse elasticity of wire, say 10,500,000 to 12,000,000 for charcoal iron wire and steel; r radius to center of wire in coil; n effective number of coils; f greatest safe shearing stress, say 30,000; W any load not exceeding greatest safe load; v corresponding extension or compression; W_1 greatest safe load; and e_1 greatest safe steady extension or compression. 2. Does F. F. Hemenway's Indicator Practice and Steam Engine Economy give rules for calculating the theoretical rate of water consumption from the indicator diagrams. *A.*—Yes. You will find it to be a very serviceable book. It gives plain directions for attaching the indicator, taking diagrams, computing the horse-power, drawing the theoretical curve, calculating steam consumption, determining economy, locating derangements of valves, and making all desired deductions; also tables required in making the necessary computations, and an outline of the current practice in testing steam engines and boilers.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 170 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Wrist-Pin Machines. Pedrick & Ayer, Philadelphia, Pa.

Horizontal and Radial Drilling Machine. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

$13.00 I Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

Headquarters for Star Hack Saws, Miller's Falls Co., 93 Reade Street, New York.

S. A. Smith, 23 South Canal Street, Chicago, Ill., agent for Holbrook's Raw Hide Blanks for Gears.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks, Clev'd, O.

Boston Gear Works, Boston, Mass. Gear cutting of every description; noiseless gears a specialty.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

For Sale—One No. 2 second-hand Brown & Sharpe milling machine, used but very little, good as new. W. P. Davis, Rochester, N. Y.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

Milliken & D'Amour, No. 151 Cedar street, New York City, designers and builders of labor saving and automatic machinery and tools to order.

Valuable Books for Machinists and Engineers Send for complete Catalogue to Norman W. Henley & Co., 150 Nassau Street, New York.

25" } "Only Drill Press built on
32" } 'Ko-rekt' principles,
37" } even if they come from Jersey."
42" } Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt Street, New York.

"Hawkins' Calculations for Engineers," 40 Parts, 25c. each, bound, $2.50; Catalogue free; Theo. Audel & Co., Pubs., 91 Liberty St., N. Y.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co, Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2. postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

The Globe Carbon Co. has removed from Cleveland to Ravenna, O.

Some new machinery is to be placed in the Victor (N. C.) Cotton-mills.

The recently burned Lexington (Ky.) foundry plant is to be rebuilt.

F. Mehring contemplates enlarging his phosphate mill at Bruceville, Md.

The capacity of the Girard (Kan.) Zinc Company's plant is to be increased.

Some new machinery is to be placed in the water-works at Gonzales, Tex.

Some new machinery is to be placed in the Pensacola (Fla.) Gas Works.

Caleb Sterling will, it is stated, erect an electric light plant at Washington, N. C.

The Camden (Me.) Anchor Company is to erect a 120x60-foot building at its plant.

There is talk of a new manufacturing plant being erected at Jamestown, N. Y.

B. F. Rodman will rebuild his iron works, recently burned, at Washington, N. C.

An ice factory, to have a daily capacity of fifty tons, is to be erected at Augusta, Ga.

The Rockingham Machine Company, of Exeter, N. H., is talking of enlarging its plant.

C. B. Gravely, of Henry County, is reported as to establish an iron foundry in Salem, Va.

The erection of two large buildings will enlarge the Valley Iron Plant at St. Paul, Minn.

A cotton-mill may possibly be built at Monroe, La. For information address W. A. Bright.

The Silver, Ocala & Gulf Railroad Company will locate its machine shops in Dunnellon, Fla.

An addition is being made to the plant of the Yazoo City (Miss.) Electric Light Company.

It is said that large sheet-mills are to be erected at Millerstown, Pa., with Pittsburgh capital.

There is talk of placing a new pump and boiler in the water-works at Huntsville, Ala., soon.

The Fallston (N. C.) Manufacturing Co. states that it expects to erect a cotton-mill next year.

Work has commenced on the erection of the Wooster & Wilcox machine shop at Winsted, Ct.

A large two-story addition is being made to the Locke Machine Company's plant at Bradford, Pa.

It is stated that the Rohrerstown Rolling-mill is to locate at Topton, Pa., with $30,000 new capital.

C. John Reily, manufacturer of iron railings for bridges, etc , is to enlarge his plant at Pittsburgh, Pa.

The new galvanizing plant of the Britton Iron and Steel Co., at Cleveland, O., is nearing completion.

A nut lock factory will be established at Newport News, Va., by L. H. Young, of Montreal, Can.

B. F. Rodman's new iron works at Washington, N. C., will have an increased capacity over the old plant.

It is probable that the pumping station at the water-works at Wheeling, W. Va., will be enlarged.

The Romig Manufacturing Co., of Auburn, N. Y., is to build a $12,000-factory of brick, five stories, 45 x60 feet.

The Rock Hill Electric Light Co , Rock Hill, N. C., will put another engine and dynamo in its electric light plant.

At Seattle, Wash., the Pacific Iron and Steel Company has been organized, with a capital stock of $60,000.

J. M. Barker states that a steel plant will be constructed at Bristol, Tenn., work on same to commence soon.

The Eagle Rolling-mill Company, of New Ulm, Minn., capitalized at $300,000, have filed articles of incorporation.

The Florence (Ala.) Gas, Electric Light and Power Co. is reported as to put a new dynamo in its electric light plant.

Chase & Woodward, of Boston, Mass., are reported as to erect an electric light plant in Elizabeth City, N. C.

Mr. Snyder is reported as to put a new engine and dynamo in his electric light plant at Point Pleasant, W. Va.

Great progress is being made in the erection of Stormer Brothers & Sykes' new machine shop at Jamestown, N. Y.

The Wichita Iron Foundry and Machine Works have been chartered at Wichita, Texas, with a cash capital of $250,000.

The Shultz Belting Company, St Louis, Mo., have filed affidavit of increase of capital stock from $300,000 to $50 ,000.

The citizens are endeavoring to secure the establishment of an iron foundry and other enterprises, at Pittsburg, Texas.

The American Tin-plate Company, of Elwood, Ind., has broken ground for its immense works in the natural gas belt.

The citizens of Pittsburgh, Tex., are endeavoring to secure the establishment of an iron foundry and other enterprises.

Wright & Wright, manufacturers of machinery at Indianapolis, Ind., are building an extensive addition to their factory.

It is reported that the Whitney Electrical Instrument Company, of Boston, intends erecting a factory at Penacook, N H.

Whitley County, Ky., of which Williamsburg is the county seat, will issue bonds for the construction of five iron bridges.

The plant of the Wilson Aluminum Company, now in course of construction at Spray, N. C., will have a capacity of 4 0 pounds daily.

Anna Furnace, at Struthers, O., has blown out for general repairs, including relining and the renewing of some of the machinery.

The Ashland Electric Light and Power Company will put a 750-light Westinghouse incandescent dynamo in its electric light plant.

J. R. Miller, J. W. Lyons, R. E. Watson and others have incorporated the Pulaski (Va.) Electric Company, with a capital stock of $25,000.

The Bessemer (Ala.) Electric Co. will repair and put in operation its electric light plant reported in this issue as damaged by a boiler explosion.

J. B. Clough has purchased the ice factory and machine shops of A. G. Kingsbury, at De Land, Fla., for $14,350; will doubtless operate same.

A northern party is negotiating for the erection in Houston, Texas, of a $250,000 sewing machine factory. Spencer Hutchins can give information.

The Mangan Manufacturing Company has been incorporated, with a capital stock of $100,000, for general manufacturing purposes, at New Orleans, La.

The Berlin Iron Bridge Co., East Berlin, Conn., has designed and will erect a new iron boiler-house for the Oswego Pulp and Paper Co., Fulton, N. Y.

Thomas Alston, of Charleston, has, it is stated, purchased the iron foundry and machine shop of R. F. Divver, at Anderson, S. C., and will operate same.

It is reported that the manufacture of farming-mills and grain-cleaning machinery has been established at Hastings, Minn. John Lucas can inform.

The directors of the Premier Steel Works held a meeting recently at Indianapolis, Ind., it is thought for considering the advisability of extending the plant.

The Bartow (Fla.) Phosphate Co. has completed its phosphate plant, previously reported, and report says that it will erect another one in the near future.

East River Metal Works, of New York, has been incorporated by Henry H. Levy, Jennie Levy, Israel Schoenburg, Rebecca Schoenberg, Andreas Keyser.

A new company has leased the Christie Machine Shop and Foundry, at Brandon, Vt., and will operate them in the manufacture of stone-cutting machinery.

The Baltimore City Passenger Railway Company, Baltimore, Md., has purchased sites for power-houses for its cable roads. J. C. Gott will prepare the plans.

The Illinois Bolt and Nut Works, of Peoria, Ill., has absorbed the Peoria Rolling-mill Company, and will use the plant hitherto occupied by the latter company.

John W. Fry, of Linnville Tenn., purchased the works of the Serage & Reynolds Pump and Lumber Co., Florence, Ala., and will, it is stated, operate same.

The Richmond (Va.) Ice Machine Company will issue about $7,000 of additional stock to adjust its finances and continue the operation of its ice machine works.

The American Bridge and Iron Company, of Roanoke, Va , has put new machinery in its blacksmith shop, including a boring-mill, and will put in a large crane.

The Aetna Foundry and Machine Company has been formed at Springfield, Ill., for the operation of a foundry and machine works. The capital stock is $15,000.

Work has been begun on a large manufacturing plant to be known as the Southwestern Steel Post Co , near East St. Louis, Ill. The company will make steel posts.

The Waukegan Iron and Steel Castings Company has been organized at Waukegan, Ill., and their works are expected to be ready for operation by the first of November.

The Texarkana (Ark.) Hardware Co. has been organized with W. B. Kizer, president; J. M. Kizer, vice-president, and C. C. Dorrian, secretary. The capital stock is $20,000.

The Woodstock Iron Co., Anniston, Ala., has submitted to its stockholders a proposition for a loan of $2 per share to be used in improving and operating its two coke furnaces.

The Cookshire Machine Works Co., at Cookshire, Que., has been incorporated, with a capital stock of $30,000, for the purpose of manufacturing machinery, foundry appliances, etc.

It is reported that the American Foundry Company intends enlarging its plant at Edison, Wash., and that new machinery for the manufacture of all kinds of car wheels will be added.

It is stated that a Pittsburgh company will locate a large steel plant in Lincoln township, above Reynoldton, about two miles from McKeesport, Pa. It will have a capital stock of $300,000.

The Kidd Steel Wire Company, now operating temporarily at Harmersville, Pa., have purchased the Bollman Works at Sharpsburg, and will manufacture fine steel and dentists' drills.

The city council has adopted a resolution providing for the construction of a $10,000 iron bridge over Gayoso Bayou at Mill street, Memphis, Tenn. The mayor can give further particulars.

The J. H. Kerrick Machinery Co. have filed articles of incorporation at Minneapolis, Minn. The capital is $50,000, and the business will be that of manufacturing iron and wood-working machinery.

A new machine shop and office building is to be erected at Charlestown, Mass , for the Carson-French Machine Company, of Boston, to be 22x113 feet, one story, with a boiler house wing 10x14 feet.

G. A Hanson has succeeded in organizing a company to develop phosphate mines and erect works on Lake Hancock, Tampa, Fla., and will incorporate same as the Lake Hancock Phosphate Company.

C. C. Pool, A. H. Graves and G. A. Prescott have incorporated the Prescott Steam Heating Company, of Chicago. The company proposes to manufacture car heating apparatus; capital stock, $150,000.

The new foundry of the Noyes & Nutter Manufacturing Company, at Bangor, Maine, has been put in operation. The plant consists of six buildings, thoroughly equipped with the most improved machinery.

Messrs. L. M. Rumsey, C. D. McClure and Paul A. Fusz have incorporated the Madison Railway Equipment Company, of Madison, Ill., with capital stock of $100,000. The company will deal in railway supplies.

The citizens of Blairsville, Pa , are making an effort to establish a rolling-mill and tin-plate works in that place. About $65,000 will be required, toward which it is said $50,000 has already been subscribed.

Plans have been prepared for a foundry, machine shop and pattern shop, to be erected at Brooklyn, N. Y., for Poulson & Egar. The buildings will be one and four stories high, built of brick, and will cost about $30,000.

A number of improvements are being made about the Carpenter Steel Works, at Reading, Pa. A new foundry building is about ready for occupancy, and a building, to be used as a machine shop, is in the course of erection.

The Lewis Foundry and Machine Company, of the South Side, Chicago, is erecting a new foundry department at its plant on 10th street. The old building has been torn down, and an iron building 95x100 will be substituted.

It is stated that a large company is now preparing plans for the erection of a complete tin-plate plant at Pittsburgh, Pa. They will do all the work, from rolling the steel billets into black sheets to the final process of tinning.

A $10,000 model of a stamp mill for reducing copper, now the property of the State Museum of Michigan, will be shown at the World's Fair. This model was made and presented by the Calumet and Hecla Copper Company.

The American Engineering Company, of Jersey City, N. J., capitalized at $1,000,000, have been incorporated. The object of the concern is the construction of steam and electric power plants, and the manufacture of machinery.

The Thayer & Britton Co., of Chicago, has been formed, to manufacture and sell car and locomotive bearings, brass and bronze castings, etc.; capital stock, $100,000; incorporators, Frank W. Thayer, Frank H. Britton and Louis Danzier.

Thomas H. Dallett & Co., of York street and Sedgley avenue, Philadelphia, manufacturers of portable and boiler shell drills and electric motors, have opened a branch office at 126 Liberty street, New York, in charge of Mr. Newton L. Schloss.

The Aultman & Taylor Co., Mansfield, Ohio, recently made what is said to be the largest single shipment of threshing machines, engines, etc., ever made by an American manufacturer of agricultural machinery. The shipment was to Mexico.

It is said that the inventors of a steel car desire to raise a company to build the same, and would like to establish the plant in Taunton, Mass. It is probable that an attempt will be made to secure a new and what seems to bid fair to be a big industry.

The Connell & Dengler Machine Company, of Rochester, N. Y., has just been incorporated, to make machines and machine supplies, and to operate a foundry. Capital, $1,000; directors: John Connell, Valentine Dengle, Jacob S. Irwin and others.

It is reported that Atlanta capitalists have made a proposition to the owners of Barnett Shoals, near Athens, Ga., for the use of 10,000 horse-power from same, intending, if the owners accept the proposition, to erect an electric plant to convey power to the city.

The plant of the National Forge and Iron Company, at East Chicago, who made an assignment August last, has been ordered to be sold by the receiver on October 27. The works formerly did a business of $1,000,000 a year, and employed about 300 hands.

The Louisville & Nashville Railroad Company are said to have subscribed $100,000 to the stock of the Southern Steel Company, who are organizing to build a steel plant at Ensey City, Ala. The proposed capital is $800,000, of which $750,000 is now subscribed.

It is thought the Fields Tack Manufacturing Company, of Taunton, Mass., may locate at Somerset, same State. The material being made there, the company thinks it to its interest to make the change, as the saving in transportation would be a large one.

The Milner Lock and Manufacturing Co. has been incorporated at Denver, Col., with a capital of $10,000 The incorporators are W S Wood, B. D Allen, W. H. Bolthoff and Joseph Milner. The object of the company is to manufacture a tumbler lock for the hardware trade.

There have been distributed 10,000 of the lithographs of Machinery Hall, at Chicago, of which New York City and State have received the largest number. Over 1,000 requests are now on file from leading manufacturers, merchants and importers of New York City and eastern States.

The Challenge Manufacturing Co. has been organized at Portland, Me., for the purpose of manufacturing mining machinery. The company has a capital stock of $100,000, and its officers are: President, Jerome V. Allen, of Brockton, Mass.; treasurer, George A. Dunbar, of Brockton, Mass.

C. H. Bullock, 1357-1361 Ridge avenue, Philadelphia, Pa., has issued a circular illustrating and describing Halsey's Patent Machine Tools. The design of these tools has arisen from actual shop practice, and there will be found in the catalogue many things of interest to machinists and manufacturers.

Jones, of Binghamton, N. Y., has nearly completed the extensive additions—in the way of new buildings—to his former extensive scale works. His original plans of improvement represented an outlay of some $20,000, but the growth of his business of late induced him to enlarge his plans to an expenditure of $45,000.

In our last week's issue we wrote that C. E. Sterne and Beecher Sterne would build and equip a foundry, blacksmith, machine and pattern shop, capital, $25,000, making marine work a specialty, and manufacturing railroad supplies at San Diego, Cal. In part of our edition the name was printed *Steme* instead of *Sterne*, hence this correction.

At Baltimore, Md., S. T. Williams has succeeded in organizing a $50,000, full paid, stock company, to manufacture his patent engine. The company will be incorporated as the Williams Engine Co., with James B. MacNeal president, and W. S. Williams, secretary; a plant of machinery and tools will be purchased and put in immediately, at a cost of $20,000.

W. W. Callery & Co., Thirty-sixth and Butler streets, Pittsburgh, Pa., are now sending samples free of their Winterton Metal Polish. Class A is designed to clean and polish *hot* brass, copper, nickel, etc. Class AA is for the same metals *cold*, while Class B is for finished iron and steel. They lately received a considerable order for their polish from New Zealand.

The Joseph Dixon Crucible Company, Jersey City, N. J., has for a number of years been making a graphite mixture that has come into extensive use by machinists, steam fitters, etc. Now the *Moniteur Industrielle* has discovered the fact that all screws in machinery should be treated with such a mixture, as it effectually prevents their becoming fixed, protects them from rust, and facilitates tightening up.

Keuffel & Esser Co., New York, the well-known dealers in all kinds of mathematical instruments and supplies, has opened a branch house at 265 State street, Chicago, where a full stock of drawing instruments and materials, surveying instruments, etc., will be carried. Mr. Fred. Braasch (who has been with the company for twelve years) and Mr. F. M. Blanchard will represent Keuffel & Esser Co. at the Chicago house.

After six months' inactivity, the mines of the Anaconda Company, in Montana, have resumed work. Word was received at Butte by Marcus Daly from J B. Haggin, at New York announcing that the difficulty with the Union Pacific had been adjusted, and ordering work resumed as early as possible. The mines belonging to the company are the Anaconda, St. Lawrence, Mountain, Consolidated, Green Mountain, High Ore, Wake Up-Jim, Modoc, and Belle.

The Pittsburgh (Pa) Boiler Scale Resolvent Co. write us as follows: "There is no greater problem confronting steam users than that of removing and preventing scale. The most successful method employed in recent years is by the use of a non-chemical compound, the base of which is a mineral oil having a vaporizing point in excess of the highest temperature of the boiler, and which has been freed from the tar and wax found in all mineral oils. This tar, if allowed to enter the boiler, would unite with the objectionable mineral and form a putty which would settle on the sheets, tubes and flues, and cause them to burn. The compound is placed in the boiler when empty, about one quart to each 50 horse-power. It lightly coats the inside of the boiler, and wherever it touches no scale will adhere. The individual particles of scale-forming mineral take on a greasy character from the compound, and so long as this condition continues, it is impossible for them to solidify or crystallize into scale, but will remain in solution until the boiler can be emptied and washed out. We are selling a great amount of compound. On the 6th we shipped by the "Royal Prince" sixty barrels to Matanzas, Cuba. Four years ago we sold one barrel in Cuba, as a result of our little card in the AMERICAN MACHINIST. Last year we sold seventy barrels, and this year our agent informs us the business will reach 150 barrels."

The Omaha and Grant Smelter Company, Denver, Col., have decided on building an addition to their present plant that will more than double their capacity, and 500 more men will be employed, which means an addition to the population of Denver of 2,500. The cost of the new plant will be close to $500,000. The building will be 231 feet long by 100 feet wide, the same size as the present main building, making the total length of the main building, when the addition is completed, 462 feet. The addition will be made to the southwest end of the main building. The contract for the machinery has been let to the Colorado Iron Works, and President Nesmith says that it is the largest single order for smelting machinery that he has ever seen. It calls for eight new smelting furnaces, same size as those now in use at the Omaha and Grant Smelter, viz , 33x100 feet in the clear, iron work for twenty new roasting and fusing furnaces, together with all necessary slag pots, matte pots dog trucks, bullion molds; also one new equipment for Cornish rolls, crushers, screens, elevators, shafts, pulleys, etc., for a new crushing and sampling mill. The Cornish rolls are forty-two inches in diameter, with forged steel tires. The crushers are to be 11x16 inches, the same size as those now in use. This new sampling equipment will have a capacity of 200 tons a day. Included in the order is a steel-trussed girder roof, 231 feet long with a clear span of 100 feet, which is to cover the new building. The aggregate capacity of the plant when the addition is completed will be 1,000 tons per day, which is 700 greater than the capacity of the company's smelter at Omaha. There will also be put in an entirely new power plant to furnish the power for the whole works. It will consist of a 500 horse-power Corliss engine. The present power plant, consisting of one 100 horse-power engine and another 200 horse-power will be kept in reserve in case of a breakdown.

On the Cultivation of Inventive Capacity.

BY LEICESTER ALLEN.

SOLUTIONS OF THE PROBLEM ENUNCIATED IN OUR ISSUE OF OCTOBER 15TH.

The evident interest in my proposed educational scheme, as shown by numerous attempts at the solution of the problem I enunciated, and several good solutions which have been forwarded to me from the editorial room of the AMERICAN MACHINIST, afford me much satisfaction. If this success attends some other problems which I purpose in due time to present, I shall consider the practicability and benefit of this kind of training as demonstrated.

A few words at the outset regarding some faults in approaching the solution of a constructive problem, apparent in some of the attempts, and I will proceed to a consideration of the solutions.

The highest inventive skill reaches toward simplicity in construction rather than complexity; it first seeks for simple means, and if these cannot be found, it then—though always reluctantly—turns to more complex combinations.

Let me say further that an accidental discovery is not an invention, though it may be described as such in a patent specification. Neither is the application of old and well-known devices to purposes similar, or analogous to those for which they have already been used, to be called an invention, unless the person making such application chance to be ignorant of the prior use; in which case he may be said to have independently invented it. One correspondent (evidently an excellent mechanic—so good a one, indeed, that perhaps he may be unconsciously inclined to underrate the ability of others who fall somewhat below his standard) seems to have made this mistake in the meaning of the word "invention." He criticises the problem—by implication—as simple, in declaring that his solution "was devised . . . before he had finished reading the article and its requirements." He also criticises it as "unmechanical," since in his view the mechanical movements—or some of them—excluded by the restrictions in the problem debar good mechanical construction; hence he pronounces the requirements of the problem to be "not a proper test of mechanical inventive skill."

Now the problem was intended to be neither a test of mechanical nor inventive skill, but was intended simply as an elementary exercise in the use of those faculties which, when disciplined, constitute inventive capacity. My critic must excuse me if I say that he has taken a position much like that of a profound mathematician who carps at the elementary examples in arithmetic as not being good tests of mathematical skill. I might say, however, that the question of good or bad mechanical construction depends entirely upon whether or not the construction fits, as fully as possible, the purpose for which it is designed. A construction adapted to an escapement for a watch might be very unmechanical if applied to a stump-pulling machine, or to a stone crusher.

This gentleman thinks that my restrictions should have been only limited to "the simplest, most durable, and requiring the least expert attention in running." These are indeed tests of mechanical and engineering ability, but I submit that in due order they follow rather than precede invention.

I think it would puzzle my critic to devise a more practical movement for the purpose which suggested my problem, than the one he has wrought out and sent in.

I will state how the problem was first suggested. The subject of the shuttle motion in Lyall's positive motion loom was under discussion with a friend, who remarked that the movement of the shuttle carriage, effected by cords alternately wound on and wound off from rollers, the motion of which is reversed at each stroke of the lay by means of rock levers and interposed gearing which multiplies the motion sufficiently, seems an uneasy and trying kind of movement; but, as the motion of the carriage is often through a distance of from sixteen to twenty feet, and the carriage must ride on a guideway on the lay, he thought it was, after all, about the only way the carriage could be moved as required. Giving some thought to the subject, I hit upon the use of an endless belt, or chain, operating a light slide, the function of the latter being to move the shuttle carriage. This endless belt or chain idea, which the correct solution of the problem involves, and which enters into several of the solutions forwarded, was at the bottom of the problem. The shuttle carriage has to move with rapidity, which precludes the use of a reversible screw. A crank with sixteen or twenty feet throw is out of the question; a rack and pinion, or a cam motion, would be too cumbrous; a rock-shaft movement is the thing desired to be avoided; lightness is essential.

I think I have vindicated my restrictions. To have named this application in advance would, I think, have been too suggestive of the solution. I wished to call out thought on a general set of conditions; the result has shown that such a statement was entirely sufficient.

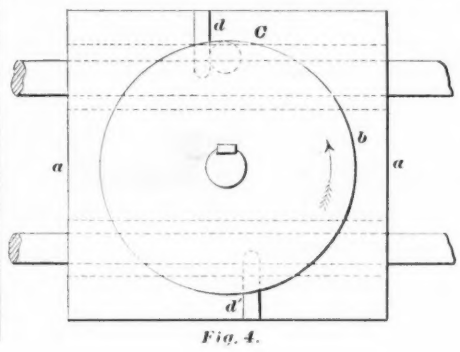


Fig. 4.

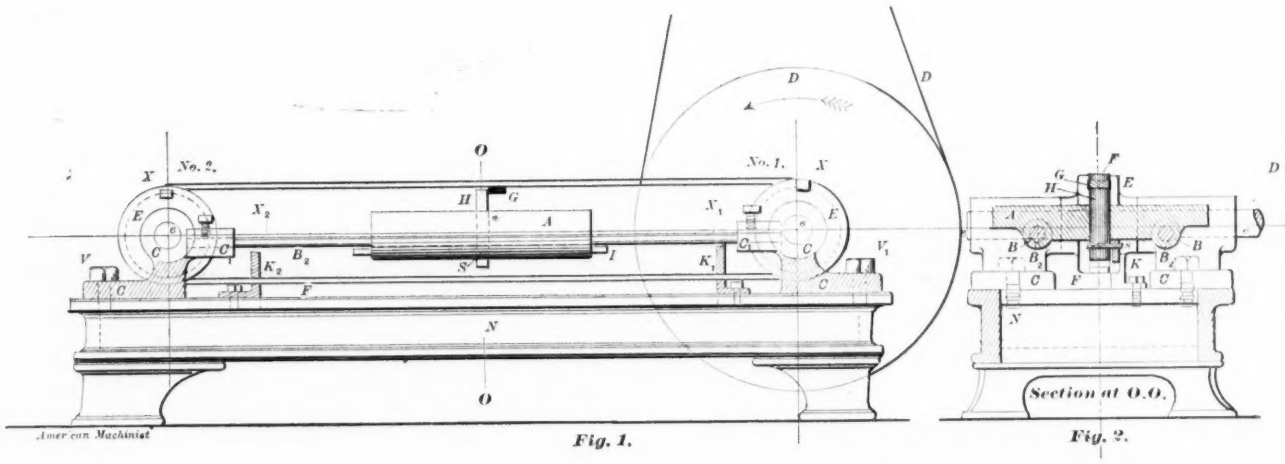


Fig. 1.

Fig. 2.

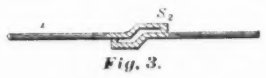


Fig. 3.

[This is an entirely correct solution for the case in which the axes of the guide rods lie in a plane at right angles with the plane in which the sprockets revolve. In the case wherein the axes of the rods lie in a plane parallel to and in all points equidistant from the plane in which the sprockets revolve, the latch and tripping mechanism are not essential, as will be evident from a consideration of the following solution.]

SOLUTION BY MR. FRANCIS W. CLOUGH, SPRINGFIELD, MASS.

"*A*, Fig. 1, is the slide having in it holes *B*, and fitted to slide easily on the rods B_2. The latter are supported by brackets *c* having hubs, in each of which is a bearing for a revolving shaft *e*. On each of these shafts are mounted sprocket wheels carrying an endless chain *F*. These latter parts are shown only in diagram, as their construction is well known to mechanics. The standards *c* are substantially supported by the bed *N*. On the chain *F* is fastened a block *G*. The chain is driven by the pulley and belt *D D*. The slide *A* has a mortise made through its center, into which is fitted a latch *H*, which has a vertical movement that causes it to engage alternately with the block *G* on the chain, both above and below the slide. Through the latch *H* is fitted a pin *s* which engages with a reversing or tripping rod *I*, shown in detail in Fig. 3. In this rod is a slot s_2.

"Now it is plain that if the motive power that drives the pulley *D* is uniform in speed, the sprocket wheels and chain will also move uniformly. The upper part of the chain will run from the pulley *D*, while the under part will run toward that pulley.

"On the bed *N* are mounted two adjustable stands K_1, K_2, which will move the tripping rod *I* when the slide *A* approaches either of the stands, disengaging the latch *H* by means of the pin *s* in the slot s_2. The slide *A* remains at rest until the block *G* travels around the sprocket wheel and engages with the latch *H* at its lower end, when it moves again towards the pulley, or from X_2 to X_1. Then it rests again while the block *G* makes the circuit of the sprocket wheel No. 1, when the block *G* again engages the latch. Thus are fulfilled all the conditions and requirements of the problem."

SOLUTION BY MR. E. H. POWERS, BELOIT, WISCONSIN.

"The slide *a*, Fig. 4, has on its flat face two lugs *d d'*. The pulley *b* rotates in a plane parallel to the axes of the guide rods, and at every point equidistant from the plane of said axes; hence, also, equidistant at all points from the flat face of the slide; *c* is a pin which engages and disengages alternately the lugs *d d'*. The motion of *a* may be indefinitely extended by the use of two pulleys instead of one, these pulleys carrying a flexible connector (as a belt or endless chain) having attached to it a laterally projecting pin acting as the analogue of the pin *c*. The period of rest will be the time occupied by the pin in traversing the arc between the point of either of the lugs and the engagement of the other."

[This is an extremely simple and clear solution of the problem—the best yet received. Some other more complicated yet interesting solutions will follow in due order.]

A $10,000,000 mortgage was recently recorded in Newark, N. J., by the Lehigh Valley Railroad Company. It was in favor of the Central Trust Company of New York, to secure bonds, which mature October 1, 1941. The mortgage covers the railroad's leased lines—the Roselle & South Plainfield, Newark, Newark & Roselle, Jersey City Terminal, Newark & Passaic, Newark & Western, and Edgewater lines, and also all the real estate and rolling stock of the main line.

Machinists' Supplies and Iron.

NEW YORK, October 31, 1891.

Iron—American Pig—The demand is slow and the market unsettled, sales having been made at lower figures.

We quote: Standard Northern brands, No. 1 Foundry, at $16 to $17; No 2 is selling at $15 to 16.50, and Grey Forge at $13.75 to $14 50. Southern brands of good quality are obtainable at $16 to $17 50 for No. 1 Foundry; $15.75 to $16 for No. 2; and $14 to $14 50 for No. 3.

Scotch Pig—We quote Coltness at $23, and Eglington at $20.50.

Antimony—Prices are still firmly maintained, but not much business is being done.

We quote Hallett's, 11⅝c.; Cookson's, 14c.; L. X., 12½c.

Copper—Trade is very quiet, the Lake companies not offering supplies at current rates. Values range from 11.40c. to 11.80c; Casting Copper, 11¼c. to 11⅝c.; and Arizona Ingot at 12c. to 12¼c.

Lead—The market is totally without interesting features, values showing a tendency to fall, and holders making almost no offerings, while buyers seem equally indifferent. Spot supplies can be had at 4¼c to 4⅜c.

Lard Oil—The market is steady at 54c. to 55c. for Prime City; Western on spot, 53c to 54c.

Spelter—Little or no business is being done, and values are nominal at 4.90c. for spot or shipments.

Tin—The market is quiet and steady, the speculative interest not being active. Values are about 20.05c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Machts in every shop to sell the best surface gauge; big profits E G. Smith, Columbia, Pa

An experienced draftsman and designer wants employment. O. H. I. O., AMERICAN MACHINIST.

A foreman for foundry open for engagement. A No. 1 refs. Address Box 93, AM. MACHINIST.

Wanted—An engineer and machinist to set up engines; state experience, and wages expected. C. H. Brown & Co., Fitchburg, Mass.

Wanted—Position as foundry foreman; 20 years' experience in Corliss engine and general jobbing work. Address Business, AMERICAN MACHINIST.

Mech draftsman and engineer, graduate of Berlin Technical College wants situation. Address Box 92. AMERICAN MACHINIST.

Wanted—Pattern maker to take charge of pattern room. State wages wanted, experience, etc. The Henley Machine Tool Works, Richmond, Ind.

Wanted—A superintendent for brass works making engine and boiler fittings a specialty. One able to construct special tools pref'd. H. K., AM. MACH.

A young Norwegian wants position as draftsman; has taken a technical course, and has 4 years shop practice. Address 24 Years, AM. MACHINIST.

Wanted—A draftsman and designer; one familiar with mining and ore-washing machinery preferred. Address South, AMERICAN MACHINIST.

Wanted—Quick and accurate tracer for drafting-room of Mch. Co. in large town near Cleveland, O.; permanent place to right party. Gregor, AM. MACHINIST.

Position desired as supt. by a cool-headed, driving man, well up in modern mach. shop practice & foundry work, a thorough draftsman, and a manager with a successful record. Box 90, AM. MACH.

Wanted—Assistant foreman in boiler shop; a good layer out, used to marine work and ship plating. Address, stating age and giving references, Lock Box 3, East Boston, Mass.

Experienced foreman pattern maker wants situation; well up in marine and stationary engine work, cranes, tools, pumps, millwright, bridge and elec. pattern work; good refs. Box 94, AM. MACH.

Wanted—Position as supt. or foreman, by a practical engineer and machinist of wide exp. on marine engines, machine tools, and electrical machinery; well up in modern practice, and the economical management of men. Energy, care AM MACH.

Superintendent—Wanted position as Supt. or assistant by a mechanical engineer; competent to take entire charge of factory; exp. on fire work, and in designing special tools for manufacturing machinery economically. G., care AM. MACHINIST.

Correspondence solicited of parties in want of a 1st-class draftsman and designer, especially hyd. & special mach'y; technical graduate and prac. machinist, one who can make calc's & estimates, and is well up in mod. shop practice. C. R., AM. MACH.

Mech draftsman, expert in all the branches of printing press building, machine tools and general machinery, also in photographing machinery, is open for engagement. Reference, his last employer, 6 years. For further particulars address R. G., 194 W. Front street, Plainfield, N. J.

Wanted—Immediately, general foreman for a foundry and machine shop in western Penn building steam engines, and all kinds of repair work; also mfg. coal mine machinery; must practically understand the business in all its branches, must be a live man, who can handle men to advantage, and push the work, and make same economically; in answering, give experience in handling men, and mechanical skill, age, reference, and salary expected and how soon could you come. Address "Machinery," care AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Single Belt Friction Clutch Pulley. Patent or shop rights for sale. Illustrated in AM. MACHINIST Oct. 22. E. C. Lewis, Woonsocket, R. I.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Corliss engs. and gen. mach'y designed, working drawings made. A. W. Jacobi, 136 Liberty St., N. Y.

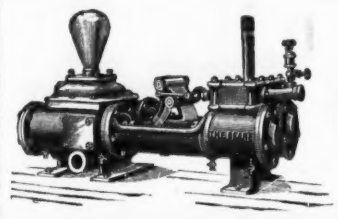
Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

To manufacture light special and automatic machinery, novelties, models, patterns, tools, etc., by Orange Machine and Repair Works, Orange, N. J.

For Sale—The Aurora Foundry; new brick building, and everything in good order for light and heavy work. Address E. W. Wilson, Aurora, Neb.

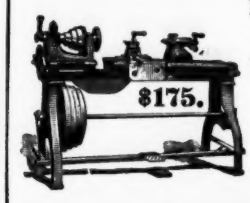
Wanted—A1 machinist or pattern maker, to take an interest in my machine shop, to manufacture small engines. 2615 & 2617 Strand, Galveston, Texas.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

FOR TOOLS. CRESCENT STEEL FOR DIES.



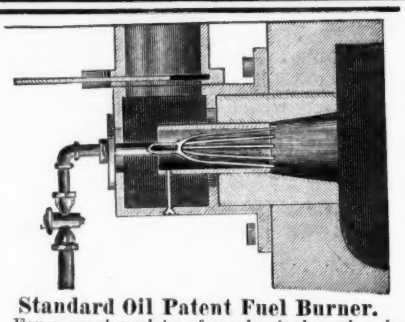
Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

Bradley Hammers

REPUTATION.
Men test everything in this world by what it produces.
2000 IN USE
BRADLEY & COMPANY,
SYRACUSE, N. Y.
BRANCHES IN NEW YORK AND BOSTON.

THE PRACTICAL CATECHISM.
(Questions and Answers on Engineering Subjects.)
By Robt. Grimshaw, M. E.
18mo, Red Cloth, - - - $1.25
JOHN WILEY & SONS, NEW YORK.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.



Standard Oil Patent Fuel Burner.
For a great variety of mechanical work using heat. Send for Illustrated Pamphlet containing experience of machinery firms.
STANDARD OIL FUEL BURNER CO.,
FORT PLAIN, N. Y.

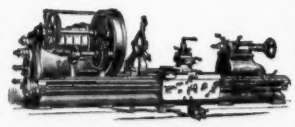
Beaman & Smith, PROVIDENCE, R. I.
21-In. Lathe

GENERAL AND EXPERIMENTAL MACHINE WORK. BEST FACILITIES IN CHICAGO
NATIONAL MACHINE WORKS, 35 S. CANAL ST. CHICAGO ILL.

THE
HOWARD MULTIPLE BALL BEARING.

We are now prepared to receive orders for this novel and valuable invention.
It can be seen in operation at our works, showing, in a test comparison with an ordinary lubricated bearing, a remarkable saving of power.
It is applicable to frictional bearings generally; such as mill and shop shafting, car and other axles, propeller and side-wheel shafts, dynamos, electro-motors, *et cetera.*
Further information upon application to the
MOSSBERG MANUFACTURING CO.
Attleborough, Mass., Nov. 1, 1891.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF
METAL-WORKING MACHINERY.
OFFICE AND WORKS:
Nos. 13 to 21 Main Street, FITCHBURG, MASS.
SEND FOR CATALOGUE E.

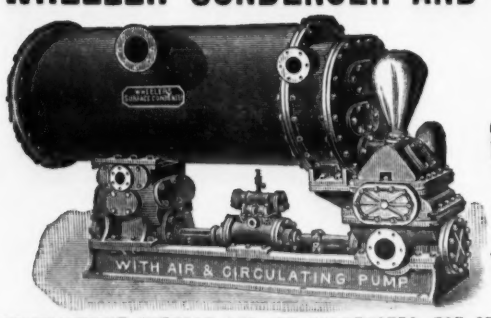


48-inch Engine Lathe.

AMERICAN INSTITUTE FAIR, Third Avenue, 63d to 64th Streets.
DAIMLER MOTOR CO.,
Manufacturers of GAS ENGINES
ADAPTED TO
STATIONARY, LOCOMOTIVE AND BOAT PURPOSES.

DAIMLER MOTOR LAUNCHES
18 to 35 feet, 1 to 10 Horse Power.
Safest, Most Speedy, Cleanest, Most Reliable and Convenient Boats. No Steam. No Coal. No Ashes.
Office, 111 E. 14th Street, New York.
Next door to Steinway Hall.
Now on Exhibition at AMERICAN INSTITUTE FAIR.

WHEELER CONDENSER AND ENGINEERING WORKS,
93 Liberty Street, NEW YORK.
Proprietors and Manufacturers of
WHEELER'S
Improved Patent Surface Condensers,
ALSO THE
Wheeler "Admiralty" Condenser,
With Patent Screw Glands.
The Wheeler-Lighthall Condenser,
With Patent Waterproof Packing.



LIGHT WEIGHT SURFACE AND JET CONDENSERS. FOR STEAM YACHTS. ETC. SEND FOR PAMPHLET.

FINE TAPS, DIES, REAMERS, ETC.,
LIGHTNING AND GREEN RIVER SCREW PLATES.

Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., Greenfield, Mass. New York Agency, 126 Liberty St.

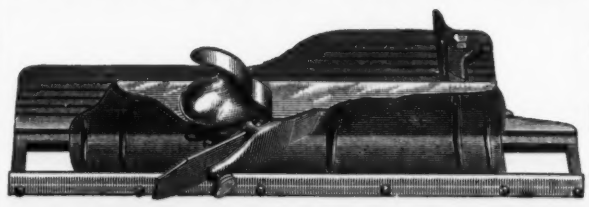
THE HACKNEY HAMMER CO.
OF CLEVELAND, OHIO,
MANUFACTURE THE MOST SUCCESSFUL
POWER HAMMER
THAT HAS YET BEEN OFFERED TO THE TRADE.
THOROUGHLY AND PRACTICALLY TESTED FOR TWO YEARS
BEFORE BEING PUT ON THE MARKET.
NOW ENDORSED BY SOME OF
THE BEST FIRMS IN THE COUNTRY.
WRITE FOR CATALOGUE AND ALL INFORMATION.

JESSOP'S STEEL
For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
Gold Medal, Paris, 1889.
MANUFACTORY,
WILLIAM JESSOP & SONS, LD. | SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

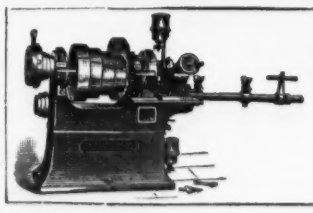
R. MUSHET'S
SPECIAL and TITANIC STEELS.
How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
B. M. JONES & CO.,
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.
143 Liberty St., NEW YORK.

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

PATTERN MAKERS' SHOOT PLANE & JACK BOARD.



A. J. WILKINSON & CO.
Box 3600.
BOSTON, MASS.
SEND FOR CIRCULAR.



IMPROVED
CUTTING-OFF MACHINES.
BETTS MACHINE CO.,
MACHINE TOOL BUILDERS,
WILMINGTON, DEL.

NICHOLSON FILE COMPANY,
PROVIDENCE, R. I.

FILES AND RASPS
FOR EVERY VARIETY OF WORK.

THE BERLIN IRON BRIDGE CO.
Office and Works: East Berlin, Conn.

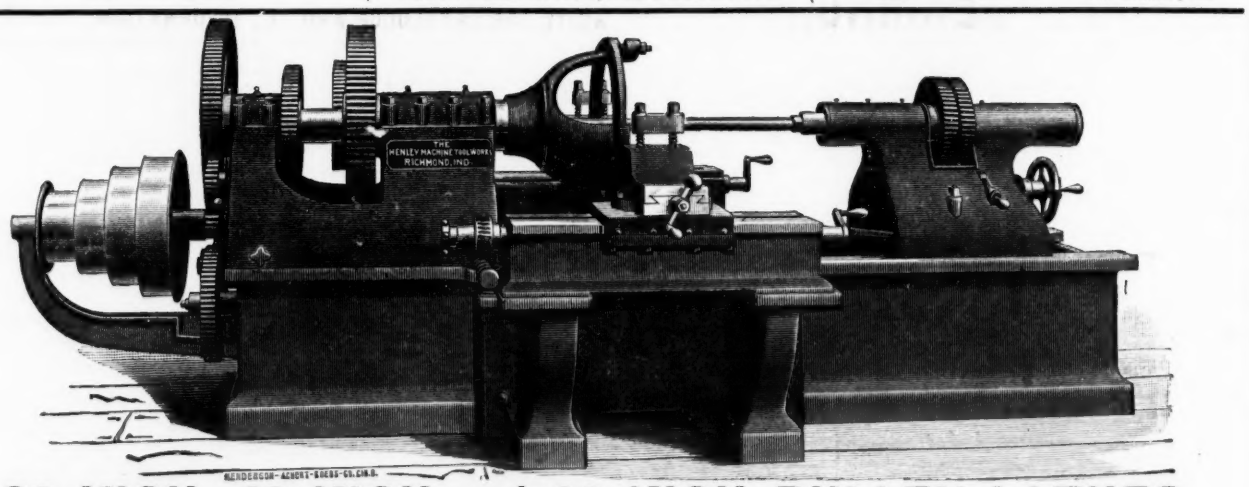
CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice-President.
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

The above illustration shows the construction of a Machine Shop built by us for The Link Belt Machinery Co., at Chicago, Ill. The wings of the building are two stories high, but the central portion is only one story in height—this being controlled and served by a hydraulic traveling crane running the full length of the building.

SEND FOR OUR ILLUSTRATED CATALOGUE.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, ETC.

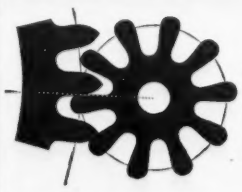


30 INCH, 42 INCH and 60 INCH PULLEY LATHES
For Simultaneously Boring and Turning Pulleys, both straight and crowning face, Cone Pulleys, Gear Blanks, and a variety of other work.
Manufactured by **The HENLEY MACHINE TOOL WORKS, Richmond, Ind.**

BUFFALO FORGES.
BUFFALO FORGE CO., BUFFALO, N. Y.

ENGINES
AND
BOILERS
FOR ANY SERVICE.
PUMPS, HEATERS & INJECTORS.
COOKE & CO.,
163 & 165 WASHINGTON STREET,
NEW YORK.

Write for our new "Engine and Boiler" catalogue. Mention this paper.



GEARS.
Cutters mathematically designed and made, either involute or epicycloid, for clocks, watches or small work.
Am. Watch Tool Co.,
WALTHAM, MASS.

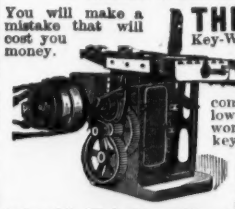
THE BRITISH & EUROPEAN PATENT AGENCY,
F. W. BARKER, Manager, (Registered English Patent Agent, According to Act of Parliament.)
252 Broadway, New York.
Monument Chambers, King William St., London, E. C., England.

American and European Patents obtained at equitable rates. *Special Facilities for Sale of Foreign Patents through our London House. A good invention is worth as much in Great Britain as in the U. S.* Competent draftsmen employed on premises. We refer to well known men in the machine trades for whom we have done business.

Epitome of the World's Patent Laws and Statistics Sent Free on Application.

If you buy a KEY-WAY CUTTER without a KEY-MAKING ATTACHMENT

You will make a mistake that will cost you money.



THE MORTON Lightning Key-Way Cutter

is the only machine on the market that will cut a Key-Way and make a Key to fit it. Mr. Geo. Newcomb, Salem, Mass., says as follows: "The Key-maker is a wonderful attachment, making keys faster than a man can cut off the steel for it. The Key way Cutter does a piece of work in fifteen minutes which requires my man seven hours to accomplish by hand." We build machines with stroke varying from six inches to five feet, and cutting from the smallest Key-ways to six inches wide.

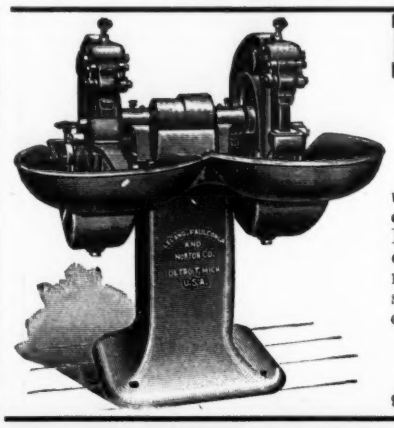
MORTON MFG. CO., Muskegon, Mich.
Formerly of ROMEO, MICH.

BRASS AND BRONZE CASTINGS
A SPECIALTY.
By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.
GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y.

REDUCED PRICES OF LeCOUNT'S LIGHT STEEL DOG.

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	5/16	$ .35	8	2	$1.10
2	1/2	.35	Small Set of 8—5.50		
3	3/4	.50	9	2 1/2	1.40
4	1	.60	10	3	1.50
5	1 1/4	.75	11	3 1/2	1.70
6	1 1/2	.85	12	4	1.90
7	1 3/4	1.00	Full Set of 12—12.00		

C. W. LeCOUNT, South Norwalk, Conn.
These goods are for sale by CHAS. CHURCHILL & CO., L't'd, 21 Cross St., London, England.



LELAND, FAULCONER & NORTON CO.
WET EMERY GRINDER.

Any amount of water easily applied without the use of Pump, Hose, Treadles, Cocks, or any of the objectionable features common in this class of Machine. Truing Device, which is inexpensive, does the work perfectly and quickly. The whole rig practically as simple as the old-fashioned grindstone trough and much more effective. Send for circular.

LELAND, FAULCONER & NORTON CO.,
96 to 106 Bates Street, DETROIT, MICH.

Pat. KEY-SEAT SETTING GAUGE
PATENT UNIVERSAL DEPTH ANGLE AND SCREW-CUTTING CENTER
TWIST DRILL GAUGE
J. WYKE & CO. For Machinists' Tools. E. BOSTON, MASS. Send for LISTS

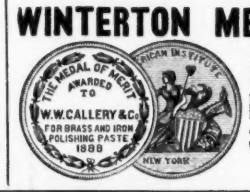
TELEPHONE CALL, 3066 CORTLANDT.
GEO. W. CHURCH, JAS. T. SLEIGHT.

GROBET FILES. Hubert's French EMERY PAPER. Kearney and Foot FILES.
P. S. & W. Files. TOOLS. STEEL.

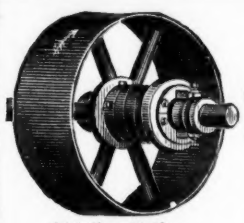
CHURCH & SLEIGHT
IMPORTERS,
TOOLS, METALS & SUPPLIES
JOBBERS.
109 FULTON ST. NEW YORK. 109

ADDIS'S Carving Tools, Chesterman's TAPES AND RULES. TWIST DRILLS, TAPS, DIES, And Machine Screws.
CABLE ADDRESS, "RUNDLEY, NEW YORK."

WINTERTON METAL POLISH.



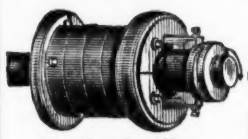
Best polish and quickest cleaner known for **HOT** or **COLD** Brass, Copper, Nickel, &c., or finished Iron and Steel. *Samples Free.* Try it.
W. W. CALLERY & CO.,
36th & BUTLER STREET, PITTSBURGH, PA.



STERLING'S PATENT Friction Pulleys and Couplings.

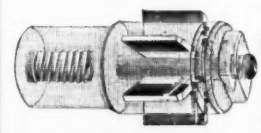
Friction Pulley.

Satisfaction fully guaranteed. All sizes from ¼ to 1,000 Horse Power. Send for Circular No. 1.



Friction Coupling.

PATENT
Adjustable Reamers
A set of 5 Reamers will ream any possible size hole from 13-16 to 4¼ in. Thoroughly tried and practical. Send for Circular No. 2.



MADE BY
CRANSTON & CO.,
57 Park Street,
NEW YORK.

Wanted

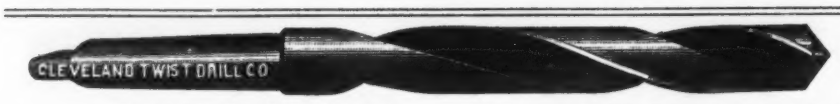
PATTERN MAKERS
TO WRITE TO
The FOX MACHINE CO.
FOR
Pocket Memorandum Book.
See Cut of "TRIMMER" in next week's issue.
Over 3,500 in Use.
Write for Catalogue.
Beware of Imitations.
THE FOX MACHINE CO.,
325 N. Front Street, Grand Rapids, Mich.

Montgomery & Co.
Machinists' Tools
AND SUPPLIES.
105 Fulton Street,
NEW YORK CITY.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.

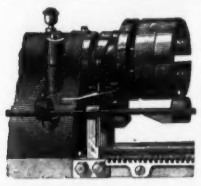
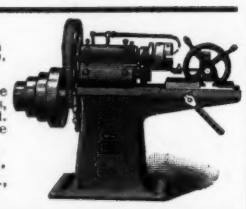
☞ Our New and Revised Catalogue of Practical and Scientific Books, 87 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

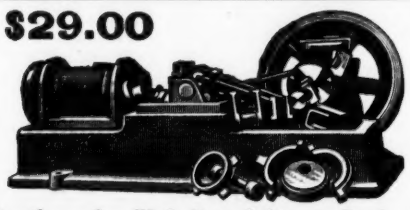
WORTHINGTON—HIGH DUTY—Pumping Engine
—FOR—
WATER WORKS
OVER 100,000,000 DUTY
—GUARANTEED—
SEND FOR RECENTLY ISSUED PAMPHLET
HENRY R. WORTHINGTON
NEW YORK CITY



Established in 1874.
CLEVELAND TWIST DRILL CO.
Corner Lake & Kirtland Sts., Cleveland, O.
100 & 102 Reade Street, New York.
85 Queen Victoria St., London, Eng

HOWE'S STEEL. FOR TAPS, DIES, PUNCHES, CHISELS, DRILLS, LATHE TOOLS, &c.
ESTABLISHED 1859.
HOWE, BROWN & CO., L'T'D., PITTSBURGH, PA.
93 JOHN ST., NEW YORK. 127 OLIVER ST., BOSTON. 228 LAKE ST., CHICAGO


ADAMS
Automatic Bolt-Threading & Nut Tapping Machine.
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
Capitol Mfg. Co., 125 to 137 Rees St., Chicago, Ill., U. S. A.
Agents for Great Britain, CHARLES CHURCHILL & CO., Ltd., 21 Cross Street, Finsbury, London, E. C., England.


$29.00

Castings for High Speed Steam Engine.
CYLINDER 4 in. x 4¼ in.
T. Shriver & Co. Iron and Brass Founders,
333 E. 56th St., N. Y. City.
Sets of Castings for Engine illustrated above, with *Cast steel Shaft, Connecting Rod* and *Rock Shaft* and *Brass Bearings*, boxed and shipped on receipt of $29.00. Three sheets *blue prints* of working drawings, extra.

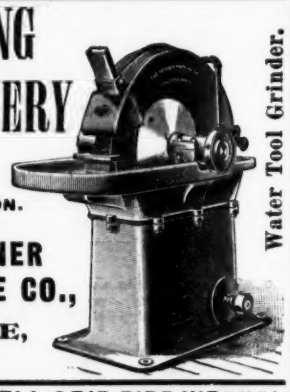
American Standard Gauge & Tool Works,
WILMINGTON, DEL.
Makers of Implements for Standard Measurements.

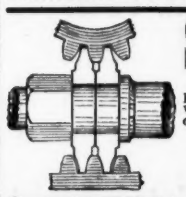
Over 48,000 in Use.
Crescent Gauge. Flat Bar Gauge.
JAS. A. TAYLOR & CO.

CHAS. A. STRELINGER & CO.,
Tools, Supplies and Machinery,
DETROIT, MICH.

BELLOWS
Beam Micrometer

Send for CATALOGUE to
STANDARD TOOL CO., Athol, Mass.

GRINDING MACHINERY

Water Tool Grinder.
PRICES ON APPLICATION.
THE HORNER MACHINE CO.,
HOLYOKE, MASS.


CLOUGH'S PATENT DUPLEX GEAR CUTTER
One pair of these Cutters cuts a pitch of interchangeable gear wheels from 15 teeth to a rack inclusive.
For circular and prices, address
R. M. CLOUGH,
TOLLAND, CONN.

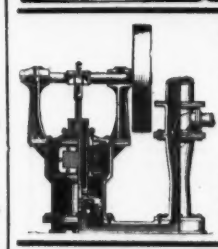
SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

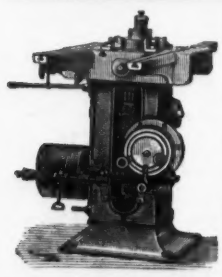
Manufacturers of Set, Cap & Machine Screws, Studs, etc.

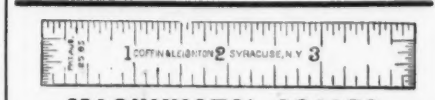
The CHAPPELL GRIP PIPE WRENCH

Self Adjusting, Perfect Grip, Instant Release, Easily Repaired. For further information address the mfr.,
A. H. ANTHONY, JEWETT CITY, CONN.

THE PECK PATENT DROP PRESS
MINER & PECK MFG CO.
SUCCESSORS TO BEECHER & PECK
NEW HAVEN, CONN.
DROP FORGINGS


Belt Power Air Pump and Condenser.
The CONOVER MFG. CO.,
CONSULTING AND MECHANICAL ENGINEERS
95 LIBERTY STREET, NEW YORK.
No Air Locks. 15 to 30 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*


KEY SEATERS
Portable and Stationary.
Back-Cutting Attachment
Key-Making Machines.
Giant Key-Seater Co.
EAST SAGINAW, MICH.
April 25, 1891. We are very much pleased with it, and think it the best machine on market for simplicity and effective work. DAVIS & COWGILL IRON WORKS, Omaha, Neb.

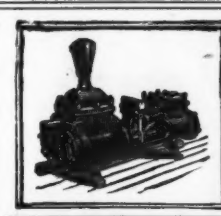


MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

FRICTION CLUTCH PULLEYS and CUT-OFF COUPLINGS.
THE WOODCOCK CLUTCH
Simplest and best in the world. Address
ALLENTOWN FOUNDRY & MACHINE CO.,
ALLENTOWN, PA.

SOMETHING NEW!
NICHOLSON'S COMPRESSION SHAFT COUPLINGS
W. H. NICHOLSON & CO., Wilkes-Barre, Pa.

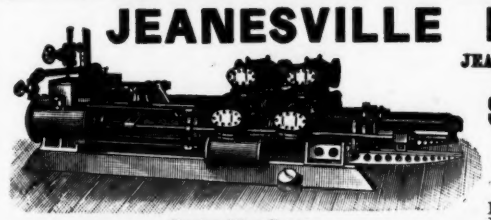
THE STILES & PARKER PRESS CO.,
Middletown, Conn.
MANUFACTURERS OF
Presses and Dies, Drop Hammers,
SHEET METAL TOOLS.
WRITE FOR PRICES.


THE BUFFALO STEAM PUMP CO.
BUFFALO, N.Y. MANUFACTURERS OF
STEAM PUMPS
FOR ALL DUTIES.

THE CANTON STEAM PUMP CO., CANTON, OHIO.
Manufacturers of
STEAM PUMPS for EVERY PURPOSE.
BOILER FEEDERS A SPECIALTY.
NEW DESIGNS AND IMPROVEMENTS.
ABSOLUTELY FIRST CLASS.
Discounts and Terms on Application.
10X6X12

2¼X1⅝X2½

SNOW STEAM PUMP WORKS,
BUFFALO, N. Y.
STEAM PUMPS, POWER PUMPS, &c., FOR ALL SERVICES.

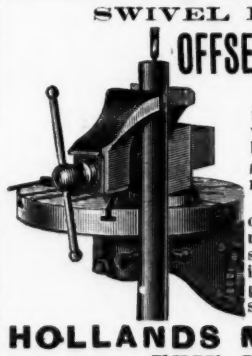
JEANESVILLE IRON WORKS,
JEANESVILLE, LUZERNE CO., PA.
BUILDERS OF
SPECIAL PUMPS OF ALL KINDS,
DUPLEX OR SINGLE, SIMPLE OR COMPOUND.

Duplex Mine Pump.
Mine Pumps, Sinking Pumps, Pressure Pumps, Vacuum Pumps, Artesian Well Pumps, Power Pumps, Etc. Etc.

COMPLETE STEAM PUMP
10 SIZES FROM $7 TO $75
FOR WATER SUPPLY TANKS, FIRE PUMPS & ETC.
WRITE FOR PRICES AND DESCRIPTIVE CIRCULARS
VAN DUZEN & TIFT
SOLE MAKERS
CINCINNATI, O.
Maslin's Patent Steam Pump.
Cheapest and Best Automatic Steam Vacuum Pump. Handles DIRTY and GRITTY LIQUIDS without Oil or Care. Simplest, and most durable Pump made, as partial removal of two bolts makes every valve readily accessible. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining and General Hydraulic Purposes. Send for Circulars. JOHN MASLIN & SON, Sole Mfrs., 165-167 1st St., Jersey City, N. J.

"PRACTICAL DRAWING."
By J. G. A. MEYER.
This valuable series of 93 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies, 5 cts. each, postpaid.

Order now before our stock of papers is exhausted.
ADDRESS:
American Machinist,
96 FULTON ST.,
NEW YORK.

"MODERN LOCOMOTIVE CONSTRUCTION."
By J. G. A. MEYER.
This valuable series of 106 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico, for $5.30, or single copies, 5 cts. each, postpaid.

SWIVEL BASE.
OFFSET JAW VISE.

Specially adapted for drill press work where chucks cannot be used, and equally good for special or regular bench work.
Send for catalogue of full line of the most improved designed, and best finished machinists' and plumbers' vises and small tools.
HOLLANDS MFG. CO.,
ERIE, PA.

C. H. BAUSH & SONS,
HOLYOKE, MASS.
MANUFACTURERS OF
POST, SUSPENDED AND WALL RADIAL DRILLS
FROM THE SMALLEST TO THE LARGEST.

STEVENS PATENT SPRING DIVIDERS
Leader, No. 75. Price, by mail, postpaid.

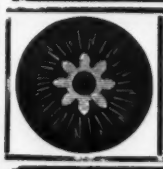
2½ inch	$0.80	4 inch	$0.90
3 "	0.85	5 "	0.95
6 inch	$1.00		
8 "	1.25		

You are quite welcome to write us at any time about improvements which you can suggest on our tools.
Ideal and Leader Spring Calipers and Dividers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 231, Chicopee Falls, Mass.

GRAHAM TWIST DRILL CO., Detroit, Mich., U. S. A.
Sole Manufacturers of GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS & CHUCKS.

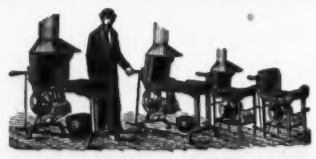
Endorsed by Practical Mechanics Everywhere. Send for Catalogue and Prices.

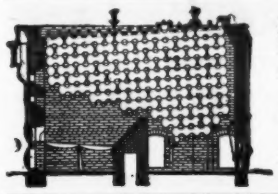
ADRIANCE MACHINE WORKS
PRESSES, TOOLS, DIES & SPECIAL MACHINERY
FOR SHEET-METAL, WIRE, PAPER & LEATHER.
PLYMOUTH & JAY STS. BROOKLYN, N.Y.


BOSTON GEAR WORKS.
BOSTON, MASS.
GEAR CUTTING.
NOISELESS GEARS
for high speed gears and pinions a specialty.

BENCH STRAIGHTENING PRESS AND CENTERS

For General Use in TOOL ROOM and MACHINE SHOP
SEND FOR CIRCULAR.
SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD, OHIO.

P. H. & F. M. ROOTS,
Connersville, Indiana,
MANUFACTURERS OF
PORTABLE FORGES, TUYERE IRONS, ETC

ROOTS' NEW ACME HAND BLOWERS
Slow speeded, Force-blast, Durable, Compact and Cheap.
Roots' Foundry Blowers, Gas Exhausters, etc.
S. S. TOWNSEND, Gen. Agt. } 163 & 165 WASHINGTON ST.,
COOKE & CO., Selling Agts. } NEW YORK.
In Writing, Please Mention This Paper.



Absolute Safety from Destructive Explosion—Highest Attainable Economy of Fuel—Rapid Generation of Dry or Superheated Steam—Durability—Low Cost of Maintenance—Ease of Transportation and General Efficiency are among the advantages possessed by the "Wharton-Harrison" form of boiler.

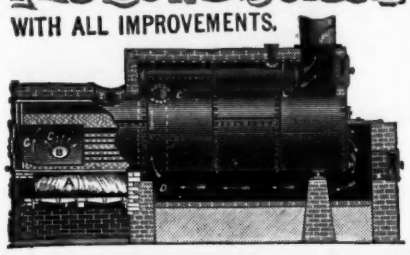
Send for Descriptive Pamphlet—Drawings, Specifications, and Estimates promptly furnished for any amount of power from 4 H.P. up.

State requirements and consider our proposition.

HARRISON SAFETY BOILER WORKS,
PHILADELPHIA, PENNA.

NEW YORK, N. Y. 41 Dey Street. | CHICAGO, ILL. 187 La Salle Street. | ATLANTA, GA. 9 No. Pryor Street.

THE LOWE BOILER
WITH ALL IMPROVEMENTS.



THE BEST TWENTY YEARS' RECORD IN EVERY RESPECT OF ANY BOILER.

Send for Description and Information on Boilers.

THE BRIDGEPORT BOILER WORKS,
BRIDGEPORT CONN.

DRY STEAM
FURNISHED BY
THE POND SEPARATOR.

The Pond Separator is guaranteed to relieve the steam of all entrained water, and return this water to the Boiler, thus effecting a large saving in fuel.

SEND FOR CIRCULAR.

POND ENGINEERING CO.,
St. Louis, Kansas City, Dallas, | Chicago, Omaha, Seattle.

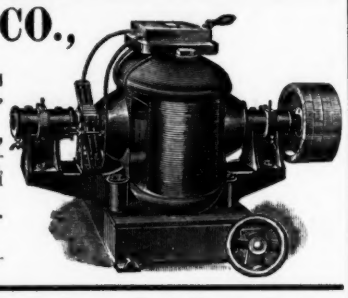
3/8" **FLEXIBLE METALLIC FILLET**
FOR PATTERN MAKERS. 8 SIZES.
H. WHITE, 44 N. 4th Street, Phila., Pa.

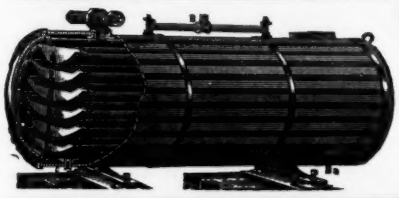
THOS. H. DALLETT & CO.,
York Street & Sedgley Ave., Philadelphia.

Manufacturers of
Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

ELECTRIC MOTORS,
Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses and other Machinery.

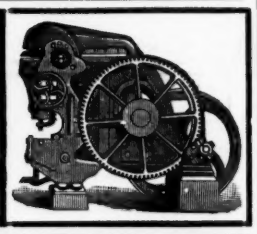
ELECTRIC GENERATORS,
For installation of Complete Power Plants.





The HOPPES Live-Steam Feed-Water Purifier,
Guaranteed to Prevent Scale in Boilers.
Using any kind of water. Hard Sheet Steel Troughs
Easily Cleaned.
HOPPES MANUFACTURING CO.,
Send for Catalogue D. SPRINGFIELD, OHIO.

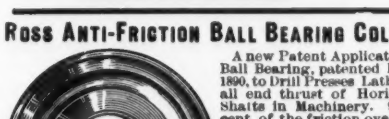
PUNCHING AND SHEARING MACHINERY
AND
BOILER MAKERS' ROLLS.
NEW DOTY MANUFACTURING CO.
JANESVILLE, WISCONSIN.



TRUMP CHUCK.
The Cheapest and Best.
WILL HOLD
ACCURATELY, STRAIGHT or TAPER
Shank Drills.
Write for Prices to
TRUMP BROS. MACHINE CO., MFRS.
Wilmington, Delaware, U. S. A.
For Sale by CHAS. CHURCHILL & CO., Ltd.
21 Cross Street, Finsbury, London, England.

Made in 3 Sizes, viz.: No. 1. Holds 0 to 1/4"
" 2. " 0 to 1/2"
" 3. " 0 to 5/8"

WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.
The Only Genuine Fossil Meal.



The best non-conducting material known for Steam Pipes and Boilers. Can be easily removed and repeatedly reapplied.
ITS PLASTIC NATURE INSURES AN ABSOLUTELY TIGHT JOINT.
Requires less thickness than any other covering, and is therefore the CHEAPEST.
FOSSIL MEAL CO., 2 Cedar Street, N. Y.
A. GIESE, Proprietor.

Trade-mark. W. B. C.

ROSS ANTI-FRICTION BALL BEARING COLLAR.

A new Patent Application of Ball Bearing, patented Dec. 2, 1890, to Drill Presses Lathe and all end thrust of Horizontal Shafts in Machinery. 95 per cent. of the friction overcome by this device. Full satisfaction guaranteed.

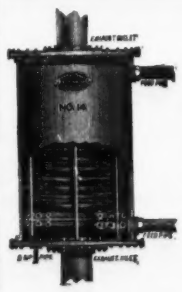
JOSIAH ROSS,
1443 to 1459 Niagara Street, Buffalo, N. Y.

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

Pencils, Graphite Car Grease, Graphite Perfect Lubricator, Belt Dressing, Crucibles, Plumbago Facing, Smoke-Stack Paint, etc.

Send for Illustrated Catalogue containing more information concerning Graphite and its uses than is in print elsewhere in any language.

F. J. SCHMITT & CO.,
30 & 32 FRANKLIN ST., NEWARK, N. J.
—MANUFACTURERS OF—
VAUGHN'S PATENT POWER HAMMER.
Can be adjusted easier and quicker than any other in use. Also
JEWELERS' MACHINERY
And Tools of every description.



THE NATIONAL
Feed-Water
HEATER.

A brass coil Heater delivering water to the boiler at 210° Fahrenheit.

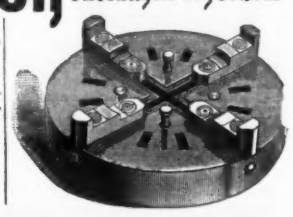
400,000 Horse power sold. Prices Low. Satisfaction universal.

THE NATIONAL PIPE BENDING CO.,
82 River Street, NEW HAVEN, CONN.

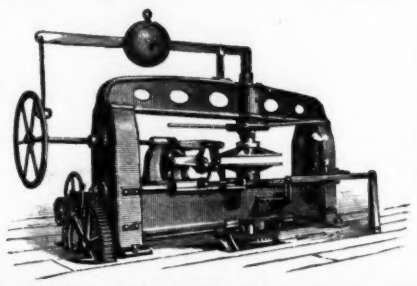
WESTCOTT CHUCK CO., Oneida, N.Y., U.S.A.
MANUFACTURERS OF
LATHE and DRILL CHUCKS.
SEND FOR ILLUSTRATED CATALOGUE.

Independent Chucks.
Jaws Reversible.
Four Jaws.

Diameter.	Capacity.
7 1/8 inch.	7 1/8 inch.
10 3/8 "	10 3/4 "
13 "	13 1/8 "
15 1/4 "	17 "
18 "	19 3/4 "
21 "	25 1/2 "
24 "	28 "



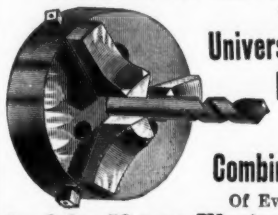
BOILER HEAD FLANGING MACHINE.



Rapid Work. Perfect Heads, with or without Dies. No Hole in Plate. Construction Simple. Price Reasonable.

JACOB CLARK, Mfr., Germantown, Philadelphia, Pa.

"THE HORTON LATHE CHUCK"
More than 300 Sizes and Styles.



Comprising
Universal Chucks,
Independent Chucks,
Combination Chucks,
Of Every Description.

Send for 52 page Illustrated Catalogue.

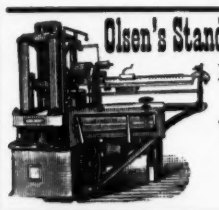
The E. HORTON & SON CO.
Windsor Locks, Conn., U. S. A.
—OR—
CHAS. CHURCHILL & CO., Ltd.,
21 Cross Street, Finsbury, London, Eng.

JUST ISSUED, No. 12.
A NEW CATALOGUE OF
LATHE AND DRILL CHUCKS,
Containing full description and price of over 20 different lines of chucks. Also special chucks never before illustrated. Sent free. Address
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

CHUCKS
Send for Catalogue and Discounts.
MANUFACTURED BY
THE HOGGSON & PETTIS MFG. CO.,
Est. 1849. NEW HAVEN, CT.

POSITIVE DRIVING DRILL CHUCK.
For either straight or taper Shank Drills.

Has the Holding Power of Taper Socket, together with all the advantages of the common Friction Chuck. Write for Illustrated Price List and Discounts to
THE PRATT CHUCK CO.,
Clayville, N. Y., U. S. A.



Olsen's Standard Testing Machines,
Hydraulic Machinery a Specialty.
TINIUS OLSEN & CO.,
MFRS.,
12th & Buttonwood Sts.,
PHILADELPHIA, PA.

BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
HUGO BILGRAM,
MACHINIST,
Successor to
BREHMER BROS.,
440 N. 12th St., Philadelphia, Pa.

INDEPENDENT CHUCKS.
(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

THE D. E. WHITON MACHINE CO.,
No. 5 OAK ST., NEW LONDON, CONN.
S. A. SMITH, 23 S. Canal St., Chicago, Western Agt.

PURE
ALUMINUM.
The Pittsburgh Reduction Co.
95 FIFTH AVENUE,
PITTSBURGH, PA.,

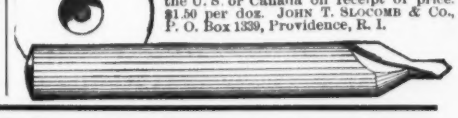
Offer Aluminum, guaranteed to be equal in purity to the best in the market, at the lowest rates obtainable. Prices given on application. Aluminum sheet, wire and castings at best rates.

ALUMINUM POLISH, very efficacious and non-poisonous, suitable for household use as well as for manufacturing purposes.

ALUMINUM SOLDER.

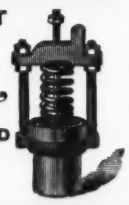
Correspondence solicited.

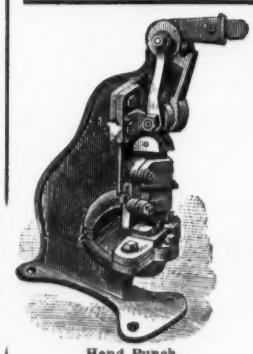
Combination Center Drills.



Made of the best steel, carefully tempered. Sent postpaid to any address in the U. S. or Canada on receipt of price. $1.50 per doz. JOHN T. SLOCOMB & CO., P. O. Box 1339, Providence, R. I.

PATENT OILERS, CYLINDER SIGHT FEED CUPS.
Government Regulation
POP SAFETY VALVES,
For Stationary, Marine and Locomotive Boilers.
J. E. LONERGAN & CO., BRASS FOUNDERS AND FINISHERS,
211 Race Street, Philadelphia, Pa.
1888 CATALOGUE FREE ON APPLICATION.





Hand Punch.

HYDRAULIC MACHINERY,
PRESSES, PUMPS, PUNCHES,
JACKS, VALVES, FITTINGS,
PACKINGS, ACCUMULATORS.
WATSON & STILLMAN, Mfrs.
204, 206, 208 and 210 E. 43d St.,
NEW YORK.

Hydraulic Flange Packings.

FLATHER ENGINE LATHES.

PERFECT MECHANICAL PROPORTIONS are the aim in designing these Lathes, and not an excessively heavy outward appearance.

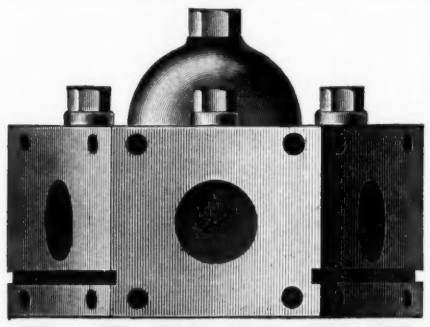
WORKMANSHIP is of the very highest grade.

PRICES are very low when quality is considered.

SMALLEST SIZE, 14 in. swing, 5 ft. bed; LARGEST SIZE, 30 in. swing, 22 ft. bed; INTERMEDIATE SIZES, 15, 16, 18, 20, 22, 24, 25, 26 and 28 in. swing, any length of bed up to 22 feet.

HILL, CLARKE & CO.

156 OLIVER STREET, BOSTON, MASS.



LATHES

NOVEL DESIGN,

GISHOLT MACHINE Co.

Madison, Wis., U. S. A.

Largest Line in the U. S.

Complete Outfits or Single Machines Furnished for any Purpose.

THE EGAN CO.,

239 to 259 W. FRONT ST.,

CINCINNATI, OHIO, U. S. A.

Originators and Builders of

WOOD-WORKING MACHINERY

OF THE MOST ADVANCED TYPE FOR THE SAVING OF TIME AND LABOR.

Send for Catalogue. Pattern Machinery a Specialty.

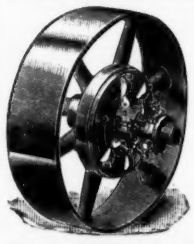
STARRETT'S

FINE TOOLS

Skilled mechanics prefer them. Live dealers sell them. Send for free illustrated Catalogue.

L. S. STARRETT, Athol, Mass., U.S.A.

LONDON AGENTS: Chas. Churchill & Co., Limited, 21 Cross St., Finsbury, E. C.



The Moore & White Co.,

15th St. & Lehigh Ave., PHILADELPHIA, PA.

MFRS. OF

The "Moore & White" Friction Clutches AND Cut-Off Couplings.

Send for Circulars.

J. A. FAY & CO.

CINCINNATI, OHIO, U.S.A.

BUILDERS OF IMPROVED

WOOD-WORKING MACHINERY

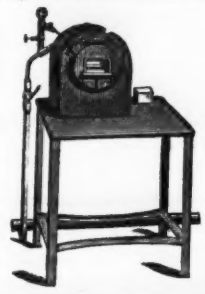
FOR USE IN

Pattern Making

Car, Locomotive and Bridge Works, Planing Mills, Sash, Door and Blind Factories, Cabinet, Spoke and Wheel Shops, Carriage Works, &c., &c.

All of the highest standard of excellence

W. H. DOANE, Pres. D. L. LYON, Sec'y. No. 1 Band Saw.



AMERICAN GAS FURNACE CO.,

DESIGNERS AND MANUFACTURERS

GAS BLAST FURNACES.

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

No. 80 NASSAU STREET, NEW YORK.

A. R. KING M'F'G COMPANY,

ERIE, 11th and 12th Streets, JERSEY CITY, N. J.

HEAVY AND LIGHT **CASTINGS** IRON OR BRASS.

MFRS. OF BOILER MAKERS' TOOLS, SCREW PUNCHES, TUBE EXPANDERS, PACKER RATCHETS, TUBE CUTTERS, ETC.

GENERAL MACHINE WORK. Write for CATALOGUE. CORRESPONDENCE INVITED

Deposited in the U. S. $845,000.00.

Policies issued giving full protection to Employers against loss by Claims from Employes on account of Acc'dent. Rates Proportioned to Risks of Occupation. One Premium the only Payment during year. No Contingent or other Liability on part of Employer.

CHIEF OFFICE IN THE UNITED STATES!

71 KILBY ST., BOSTON, MASS.

ENDICOTT & MACOMBER,

Managers and Attorneys.

BOSTON: Samuel Appleton, 28 Central St.
NEW YORK: Edmund Dwight, Jr., General Agent, 51 Cedar Street.
MIDDLE DEPARTMENT: Tattnall Paulding, Resident Adviser; John G. Hooven, Manager; John M. Ash, Jr., General Agent, 416 to 420 Walnut Street, Philadelphia.
CHICAGO: Geo. A. Gilbert, 226 and 228 La Salle St.
ST. LOUIS: F. D. Hirschberg Bro., 120 N. Third St.

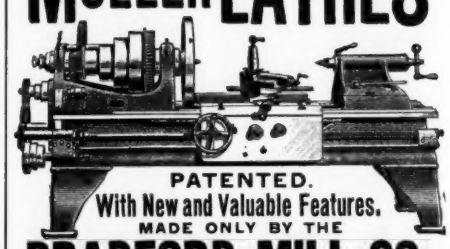
AGENTS IN ALL THE PRINCIPAL CITIES.

CHARLES MURRAY

ENGRAVER ON WOOD

58 ANN ST. NEW YORK.

MULLER LATHES



PATENTED.

With New and Valuable Features.

MADE ONLY BY THE

BRADFORD MILL CO.

8th & Evans, CINCINNATI, OHIO.

Photographs and Prices on application.

MACHINERY

For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information, address the Manufacturer,

S. W. GOODYEAR, Waterbury, Ct.

SWEET'S Measuring Machine.

The only micrometer that will not lose its accuracy by wear.

Satisfaction Guaranteed.

SYRACUSE TWIST DRILL CO.,

Syracuse, N. Y.

AMERICAN MACHINERY IN ENGLAND.

We have been introducing **AMERICAN MACHINE TOOLS** for 25 years, and supply Government and all Leading Engineering Firms Largest stock of **AMERICAN TOOLS** in Great Britain on show in our London and Birmingham Warehouses.

CORRESPONDENCE WITH MANUFACTURERS AND USERS SOLICITED.

CHARLES CHURCHILL & CO., Limited.

Branch Warehouse, BIRMINGHAM. 21 CROSS ST., FINSBURY, LONDON, ENGLAND.

☞ **Are you boring on Engine Lathes?**

☞ **If so you are losing money!!!**

☞ **Enough work bored on these machines to keep 20 Engine Lathes running**

☞ Automatic Revolving Turret.
☞ Automatic Feed to Turret.
☞ Automatic Stop to Turret.
☞ Large Hollow Spindle, 1⅞ hole.
☞ Extra Large Bearings.
☞ Combination Chuck with each machine.

NEW YORK HOUSE
64 CORTLANDT STREET.

CHICAGO HOUSE
68 & 70 S. CANAL STREET.

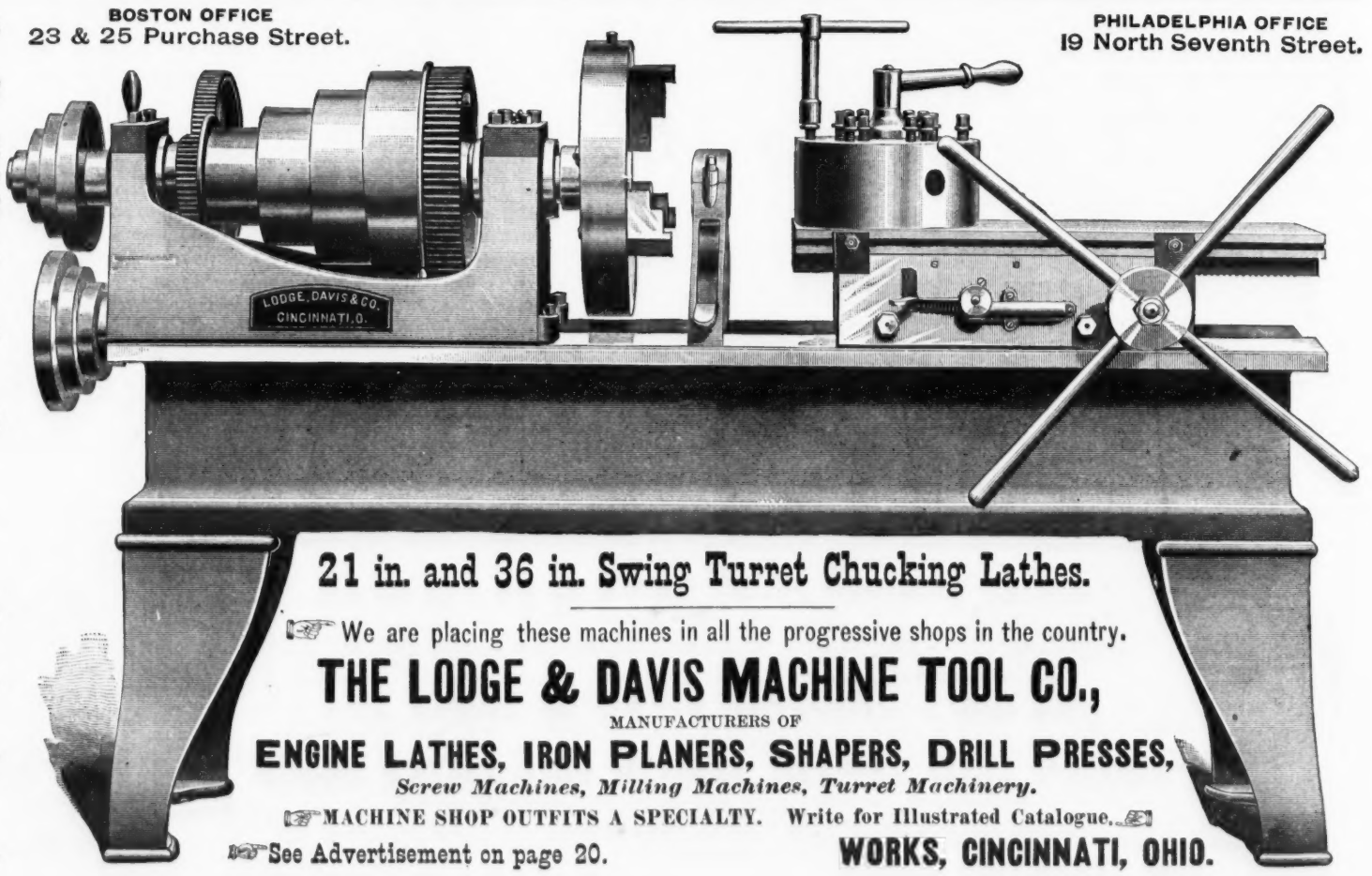
ST. LOUIS HOUSE
823 N. SECOND STREET.

PITTSBURGH HOUSE
Market & Water Streets.

Sole Agent for Great Britain,
ALFRED HERBERT,
COVENTRY, ENGLAND.

BOSTON OFFICE
23 & 25 Purchase Street.

PHILADELPHIA OFFICE
19 North Seventh Street.



21 in. and 36 in. Swing Turret Chucking Lathes.

☞ We are placing these machines in all the progressive shops in the country.

THE LODGE & DAVIS MACHINE TOOL CO.,

MANUFACTURERS OF

ENGINE LATHES, IRON PLANERS, SHAPERS, DRILL PRESSES,

Screw Machines, Milling Machines, Turret Machinery.

☞ MACHINE SHOP OUTFITS A SPECIALTY. Write for Illustrated Catalogue. ☜

☞ See Advertisement on page 20.

WORKS, CINCINNATI, OHIO.

MORSE TWIST DRILL AND MACHINE COMPANY,

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills. New Bedford, MASS.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

ENGINE LATHES from 10 to 30 inches swing
Also Hand Lathes, Foot Lathes and Milling Machines.

MACHINE TOOLS

FOR IRON, BRASS AND STEEL.

HILL, CLARKE & CO.

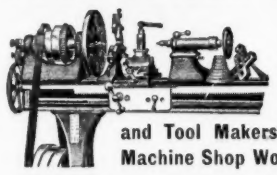
156 Oliver St., Boston.

Price $8
NO GAUGES.
NO BELT.
Every Machine Guaranteed.

BARKER'S IMPROVED CENTER GRINDING MACHINE.
Manufactured by WM. BARKER & CO. CINCINNATI, O.
SEND FOR CIRCULAR.

☞ IMMEDIATE DELIVERY.
15" and 18" Crank } SHAPERS.
20" and 26" Geared }
JNO. STEPTOE & CO., Cincinnati, Ohio.

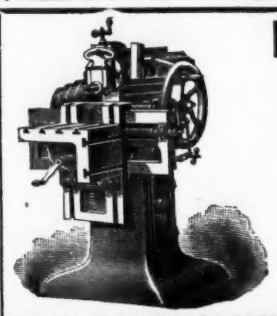
FOOT POWER LATHES



For Electrical and Experimental work. For Gunsmiths and Tool Makers. For General Machine Shop Work.

High grade tools; elegant in design, superior in construction. The best foot power lathes made, and quality considered the cheapest. Send for catalogue and prices.

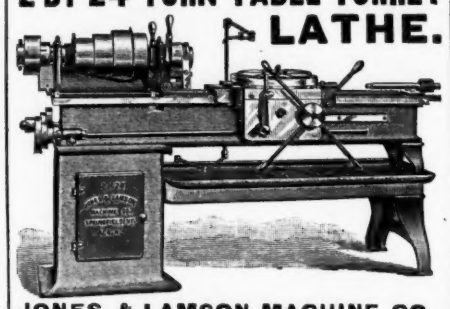
W. F. & JNO. BARNES CO.
1995 Ruby Street, ROCKFORD, ILL.



Lathes, Planers, Drills, Slotters, Etc.

NEW HAVEN MANUFAC'G CO.,
New Haven, Conn.

2 BY 24 TURN TABLE TURRET LATHE.



JONES & LAMSON MACHINE CO.,
Springfield, Vt., U. S. A.

GAGE MACHINE WORKS,

MANUFACTURERS OF
MACHINE TOOLS,
WATERFORD, N. Y.

THE PRATT & WHITNEY CO.
Hartford, Conn., Jan. 14, 1891.

KEMPSMITH MACHINE TOOL CO.,
Milwaukee Wis.

Gentlemen:
We have used one of your back-geared Universal Milling Machines for several months. The foreman in charge of the department in which it is located reports the machine satisfactory, and one that can be recommended to intending buyers as well built and convenient.

Very truly yours,
THE PRATT & WHITNEY CO.
R. F. BLODGETT, Secy.

On Sept. 22, 1891, we shipped Pratt & Whitney Co. another complete Universal Miller.

KEMPSMITH MACHINE TOOL CO.
Milwaukee, Wis.

IRON PLANERS.

Extra Heavy. Latest Design. All Modern Improvements.

L. W. POND MACHINE CO., WORCESTER, MASS.

D. SAUNDERS' SONS,

21 ATHERTON ST., Yonkers, N. Y.
MANUFACTURERS OF

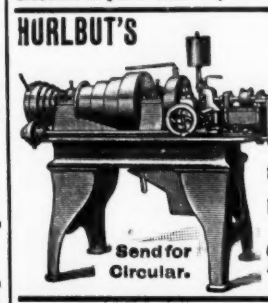
Steam & Gas Fitters' Hand Tools.

Pipe Cutting, THREADING, AND Tapping Machines.

SEND FOR CIRCULAR.

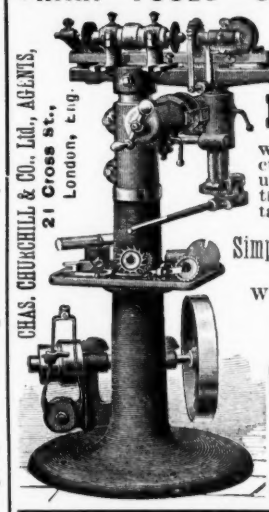
THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

HURLBUT'S



Patent Cutting-off and Centering Machine.
Sizes 2", 3", 4", 5", 6".
MADE BY
Hurlbut & Rogers,
South Sudbury, Mass.
Chas. Churchill & Co., Ltd Agents, 21 Cross St., London England.

SHARP TOOLS—GOOD WORK.



CHAS. CHURCHILL & CO., Ltd., AGENTS, 21 Cross St., London, Eng.

THIS Universal Cutter AND **Reamer Grinder** will grind all kinds of cutters and reamers up to 8" diam without the use of special attachments.

Simple, Accurate, Rapid.
Price, $150.
Write for Catalogue.
ADDRESS
THE **Cincinnati Milling Machine Co.,**
CINCINNATI, O.

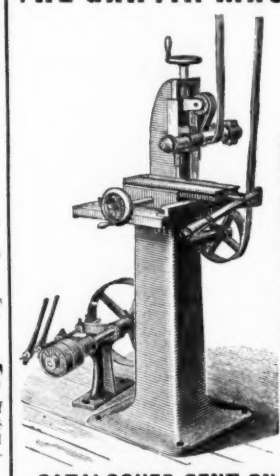
BOYNTON & PLUMMER,
WORCESTER, MASS.
Manufacturers of
Shaping Machines,
Drilling Machines,
Bolt Cutting Machines.
CHAS. CHURCHILL & CO., Ltd, Agents, 21 Cross St., Finsbury, London, England.

For Sale by CHAS. CHURCHILL & CO., Ltd. 21 Cross Street, Finsbury. London, England.

PRENTICE BROS.,
Manufacturers of
Lathes & Upright Drills.
Lathes from 10 in. to 20in. swing. Largest Variety of Drills manufactured in the world.
Worcester, Mass.

P. BLAISDELL & CO.,
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

THE GARVIN MACHINE CO.



DIE GRINDER.
This is a very desirable and handy tool, designed particularly for use in connection with punch presses for grinding and sharpening dies, punches, etc.

Manufacturers and Dealers in MILLING MACHINES, SCREW MACHINES, AUTOMATIC TAPPERS, LATHES, PLANERS, TAPPERS, DRILLS, &c.,
LAIGHT AND CANAL STS., N. Y. CITY.

CATALOGUES SENT ON APPLICATION.

FOR
Substantial, Well Made, Low Priced, Patented,
20 Inch Drills,
With latest improvements, Lever, Combination or Wheel Feed, address
Sibley & Ware,
SOUTH BEND - INDIANA.

21", 25", 27", 28", 30", 32", 35" Swing.

IMPROVED **Upright DRILLS**
21 IN TO 36 IN
J.E. SNYDER
WORCESTER, MASS.

CURTIS & CURTIS

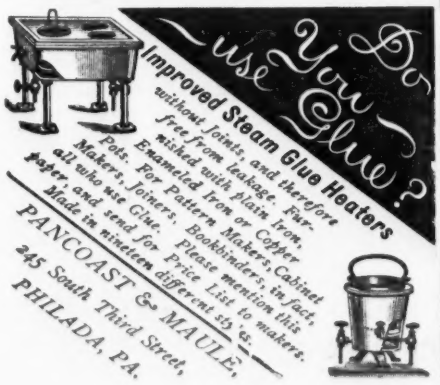
66 Garden St., Bridgeport, Ct.

THE CURTIS Pipe Threading Attachment FOR LATHES.
PIPE CUTTING AND THREADING MACHINERY
For Hand or Power.
Send for Illustrated Catalogue.

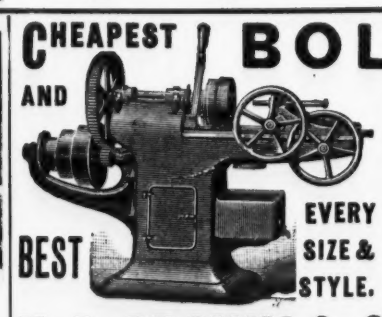
W. D. FORBES & CO., ENGINEERS.

Are open to Contract for MACHINERY, SPECIAL TOOLS, or PATENTED ARTICLES, JOB WORK. NEW SHOP. NEW TOOLS. PERFECT EQUIPMENT, NO Makeshifts. Estimates given. DESIGNS FOR SPECIAL MACHINES. TAKE 14th Street Ferry TO 1300 Hudson St., HOBOKEN, N. J.

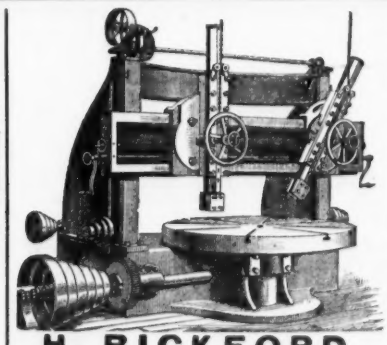
W. D. FORBES & CO., HOBOKEN, N. J.



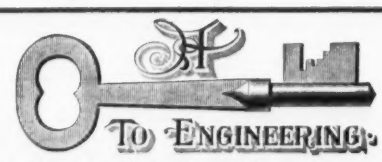
Do You Use Glue?
Improved Steam Glue Heaters
Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper and send for Price List to makers.
Made in nineteen different sty'es.
PANCOAST & MAULE,
245 South Third Street,
PHILADA, PA.



CHEAPEST AND BEST **BOLT CUTTERS.**
EVERY SIZE & STYLE.
H. B. BROWN & CO.,
EAST HAMPTON, CT.



H. BICKFORD,
LAKE VILLAGE, N. H
BORING AND TURNING MILLS, 4, 5 and 6 Ft. SWING.

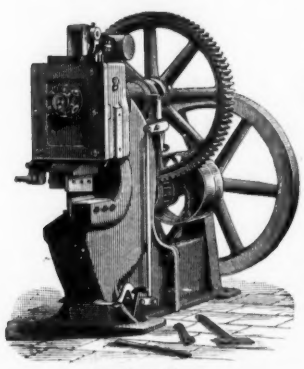


TO ENGINEERING:

Is the title of a book which we have published, written in the plainest language, by an eminent authority on such matters. It contains just the facts which every engineer wishes to know. We have already sold two editions. It is bound in leatherette, and contains no advertisements. Sent postpaid for 30 cents. Stamps taken. Please mention this paper.

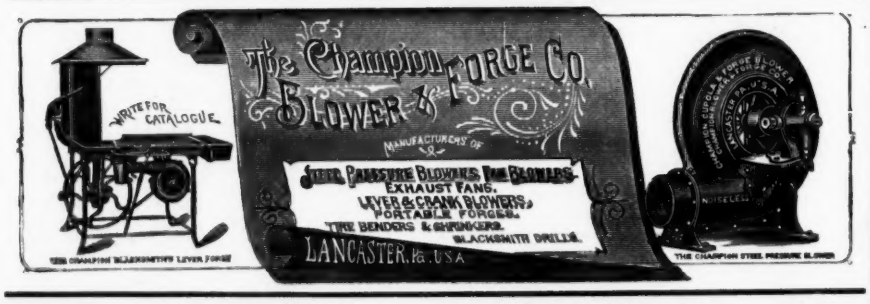
MASON REGULATOR CO.,
BOSTON, MASS.

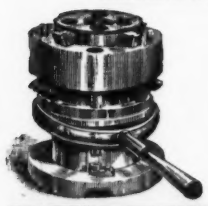
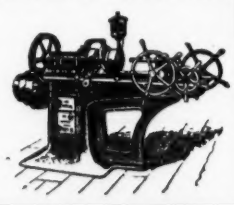
WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE

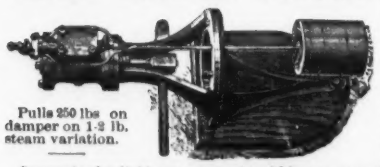
THE LONG & ALLSTATTER CO.,
HAMILTON, OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple Belt and Steam-Driven
PUNCHES & SHEARS,

Bar Iron Shear.
POWER CUSHIONED HAMMER. ALSO OVER 300 SIZES. Send for New Catalogue.

ESTABLISHED 1842.
ROBERT POOLE & SON CO.
ENGINEERS AND MACHINISTS.
MACHINE MOULDED GEARING.
ALL KINDS OF TRANSMISSION MACHINERY OF THE HEAVIEST CLASS.
BALTIMORE, MD.

THE OPEN SIDE IRON PLANERS.
DETRICK & HARVEY MACHINE CO., Manufacturers,
BALTIMORE, MD.



THE NATIONAL MACHINERY CO.
TIFFIN, OHIO.
Manufacturers of
CATALOGUE SENT ON APPLICATION.

12 Sizes of National Bolt Cutters.
6 Sizes and Styles of Rapid Bolt Cutters.
5 Sizes and Styles of Bolt Pointers.
15 Sizes and Styles of Bolt Headers.
12 Sizes and Styles of Nut Machines.
14 Sizes and Styles of Tappers.
3 Sizes and Styles of Washer Machines.
3 Sizes and Styles of Spike Machines.
2 Sizes of Car Link Machines.
3 Sizes of Car Pin Machines.
7 Sizes and Styles of Wire Nail Machines.
5 Sizes and Styles of Benders.
Complete outfits for Bolt shops.


BLAKE DAMPER REGULATOR.

Pulls 250 lbs on damper on 1-2 lb. steam variation.
Trial allowed. Correspondence invited.
Guaranteed reliable and accurate within one pound variation. Has differential motion. No Diaphragm. Nickel Plated. Prices right. JOHN H. BLAKE, 136 Liberty St., New York.

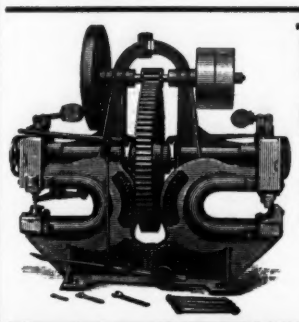
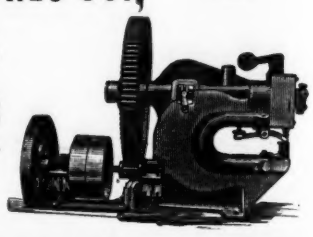
SAW TABLES FOR PATTERN MAKERS.

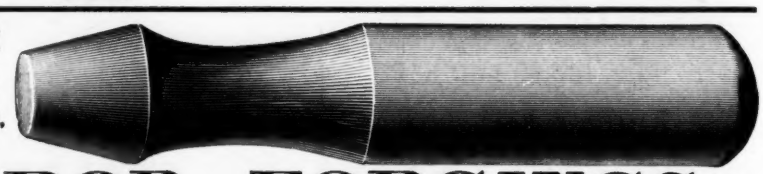
ROYLE MACHINE WORKS,
PATERSON, N. J.

ENERGY MFG. CO., 1115 S. 15th St., PHILADELPHIA.
MANUFACTURERS OF
QUICK LIFTING AND LOWERING ROPE HOISTING MACHINES.
Adjustable Clamping Blocks, Drill Guides, Elevators, Etc.
PATENT CENTER GRINDERS Guaranteed to do accurate work.
Will grind Lathe Centers true if sprung or broken, quicker than they can be turned and filed. SEND FOR CATALOGUE.

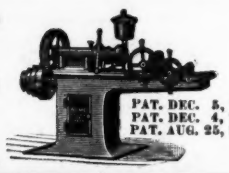
THE INDISPENSABLE LATHE DOG.
DROP FORGED FROM BAR STEEL.
One Set of 3 does the work of 12 common dogs.
No. 1, ¼" to 1¼"; No. 2, ½" to 2¼"; No. 3, 1" to 3¼".
$7.50 Per Set.
These DOGS can be attached after the work is centered in the Lathe.
PALMER, CUNNINGHAM & CO., L'd.
607 Market St., PHILADELPHIA, PA.

BEMENT, MILES & CO.,
PHILADELPHIA, PA.
—BUILDERS OF—
METAL-WORKING MACHINE TOOLS
FOR
Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.


The HILLES & JONES CO., WILMINGTON, DEL.
MANUFACTURERS OF
PUNCHES AND SHEARS,
All Designs and Sizes,
AND A FULL LINE OF
MACHINE TOOLS
FOR
Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc., etc.


WYMAN & GORDON, WORCESTER, MASS.

DROP FORGINGS.

ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.

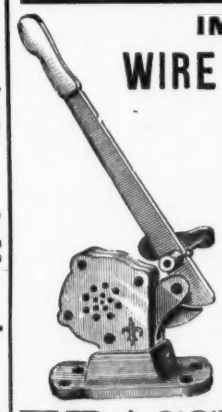

PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.

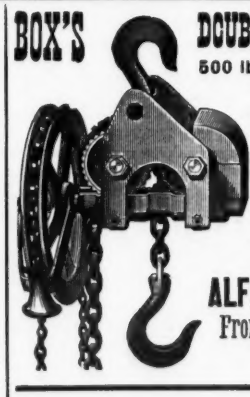
SUSPENSION AND POST DRILLS.
FOR BOILER MAKERS.
UNIVERSAL RADIAL DRILL Co CINCINNATI, O. U. S. A.

SPECIAL MILLING CUTTERS, REAMERS, DIES, TAPS,
GEARS TO ORDER.
GEAR CUTTING TO ORDER up to 60 inch Diameter.

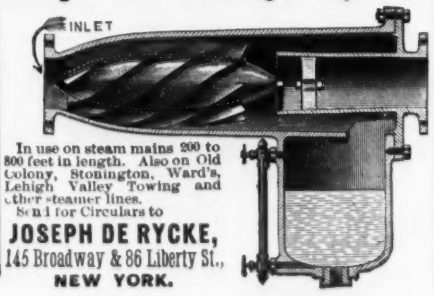
Adjustable Bladed Reamers.
R. D. NUTTALL COMPANY,
ALLEGHENY, PA.
Designers and Manufacturers of Special Machinery and Tools.

EUREKA TEMPERED COPPER CO.
NORTH EAST, PA.
MANUFACTURERS OF
WILSON'S EUREKA BABBITT.
THE BEST ANTI-FRICTION METAL EVER OFFERED TO THE TRADE.
Satisfaction Guaranteed in Every Case.

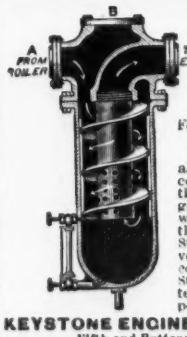
IMPROVED
WIRE CUTTERS.

No. 1 cuts wire rods without leaving burr from ¼ in. to smallest size. Price, $5.00 net each.
No. 2 cuts sizes from ½ in. to smallest size. Price, $10.00 net each. Send $1.00 for 550 page illustrated catalogue of fine tools and supplies. No charge made when $10.00 worth of goods are ordered.
FRASSE & CO.,
92 Park Row, New York.

BOX'S DOUBLE SCREW HOIST,
500 lbs. to 20 Tons Capacity carried in Stock.

Full line of Cranes usually in course of erection, from the small single track and trolley, to 50-ton Traveling and Jib Cranes.
Radial Drills for Machine Shop use.
Special Radials for Bridge Builders.
Photos and Cuts on Application.
ALFRED BOX & CO.,
Front, Poplar & Canal Sts.,
Philadelphia, Pa.

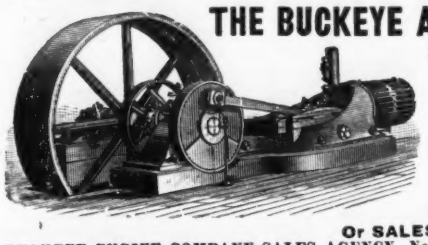
KEUFFEL & ESSER CO., NEW YORK.
Eagle BLUE PRINT PAPER.
Eagle IS THE CHEAPEST, NO WASTE, NO FAILURES.
Eagle MAKES THE BEST AND MOST PERMANENT PRINTS.
Eagle KEEPS LONGEST AND GIVES THE MOST PERMANENT PRINTS.
Eagle WHEN WASHED AND DRIED IS STRONGER THAN IT WAS BEFORE.
IMITATIONS are plentiful. The principal advantage claimed for the imitations is the low price.
We claim that Eagle is the cheapest, for the reasons stated above.
Samples, Price Lists and Information cheerfully furnished. Photo Printing for the Trade.

ABSOLUTELY DRY STEAM
CAN BE SECURED BY USING
Straight Line Centrifugal Separator.


In use on steam mains 200 to 800 feet in length. Also on Old Colony, Stonington, Ward's, Lehigh Valley Towing and other steamer lines.
Send for Circulars to
JOSEPH DE RYCKE,
145 Broadway & 86 Liberty St.,
NEW YORK.



DRY STEAM.
Simpson's Centrifugal Steam Separator.
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
KEYSTONE ENGINE AND MACHINE WORKS,
Fifth and Buttonwood Streets, Philadelphia,
Or, A. T. ARTHUR, Selling Agent, 18 Cortlandt St., N. Y.



THE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

SLOW SPEED, MEDIUM SPEED AND HIGH SPEED ENGINES,

Simple, Compound and Triple-Expansion Engines.

HIGH-PRESSURE BOILERS.

Complete Steam Power Plants of Highest Attainable Efficiency.

Address **BUCKEYE ENGINE CO., Salem, O.**

Or SALES AGENTS:

BUCKEYE ENGINE COMPANY SALES AGENCY, No. 10 Telephone Building, New York City.
A. A. HUNTING, John Hancock Bld'g, Boston, Mass. N. W. ROBINSON, 97 Washington St., Chicago, Ill.
ROBINSON & CARY COMPANY, St. Paul, Minn. A. L. FISH, No. 61 First St., San Francisco, Cal.
KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.
Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland, and Virginia.

RENEWABLE SEAT, GATE, STOP AND CHECK VALVES

ALSO MANUFACTURERS OF

"DUPLEX WATER FILTERS," "BOILER PURIFIERS,"
"RETURN STEAM TRAPS," "STEAM PUMPS,"
AND
"PUMP GOVERNORS."

SEND FOR CIRCULARS

ALBANY STEAM TRAP CO. ALBANY, N.Y.

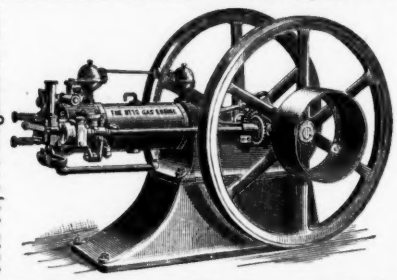
"OTTO" GAS ENGINE WORKS.

SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts., PHILADELPHIA.

Branch Office, 151 Monroe St., CHICAGO. New York Agency, 18 Vesey St., N. Y.

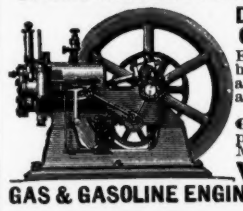
Over 35,000 Engines in Use



Guaranteed to consume 25 to 75 per cent. less Gas than any other Gas Engine doing the same work.

GAS and GASOLINE ENGINES

STATIONARY and PORTABLE. All Sizes.

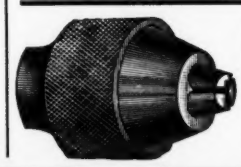


Dwarfs in Size, but Giants in Strength.

Expense one cent an hour per horse power and requires but little attention to run them.

Every Engine Guaranteed. Full particulars free by mail Mention this paper.

VAN DUZEN GAS & GASOLINE ENGINE CO. Cincinnati, O.



Almond Drill Chuck

Sold at all Machinists' Supply Stores.

T. R. ALMOND,
83 & 85 Washington St
BROOKLYN, N. Y.

ALL GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.

"Phosphor-Bronze."

PHOSPHOR-BRONZE

INGOTS, CASTINGS & MANUFACTURES.

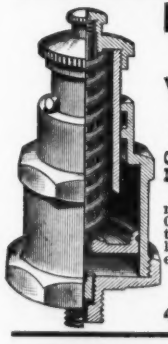
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

Freight Elevators,

Steam and hydraulic, completely equipped; or iron work only.

THE LANE & BODLEY CO.,
CINCINNATI, O.



LACKAWANNA GREASE CUP

Will Save its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR AND COST OF COTTON-WASTE, PREVENTS DRIPPING AND SPATTERING.

A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

Lackawanna Lubricating Co.,
41 Coal Exchange, Scranton, Pa.

MACHINERY

NEW AND SECOND-HAND.

Engine Lathe, 36 in. swing, 18 ft. bed, Fitchburg.
" " 32 in. " 18 ft. bed, Heavy pattern.
" " 28 in. " 16 ft. bed, " "
" " 25 in. " 12 ft. bed, New Haven, good order
" " 24 in. " 12 ft. bed, Fitchburg.
" " 24 in. " 12-14 ft. bed, Wright.
" " 22 in. " 12-24 ft. bed, Perkins.
" " 20 in. " 8-10-13 ft. beds, Wright.
" " 18 in. " 8 ft. bed, Fitchburg.
" " 18 in. " 8 ft. bed, Wright.
" " 18 in. " 6-10-10 ft. beds, Hendey.
" " 18 in. " 8 ft. bed, Prentice.
" " 16 in. " 6-8 ft. beds, Fitchburg.
" " 14 in. " 6 ft. bed, Hendey, Taper attach.
" " 14 in. " 6 ft. bed, Fitchburg, " "
" " 13 in. " 6 ft. bed, Ames
" " 12 in. " 6 ft. bed, Prentice.
Brass Lathes, Square Arbor and Turrets, all sizes.
Planers, 76 in. wide, 54 in. high, x25 ft. Betts, good order
do 36 do 36 do x12 ft. Powell.
do 30 do 30 do x8-10 ft. "
do 24 do 24 do x6 ft. "
do 24 do 24 do x6 ft. Fitchburg.
do 24 do 20 do x4 ft. Freeland, good order.
Shapers, 24 in. Stroke, Double Geared.
" 15 in. " Improved style, Hendey Al.
" 15 in. " Crank Motion, Eberhardt.
" 14 in. " Trav. head, Fitchburg.
Drills, 3 Spindle, Garvin's good order.
do 20 in. Wheel feed, Prentice.
do 20 in Lever feed, Pratt & Whitney, good order.
do 24-25-28 and 32 in. swing complete, Prentice.
Drill, Radial 3 ft. arm, new pattern.
Screw Machine, No. 1, wire feed, Brown & Sharpe, Al.
" " No. 5, do chasing bar, spring ck, Al.
Milling Machine, Universal, new pattern.
" " Lincoln pattern, good order.
Profiling Machine, Two spindles, good order
Boring and Turning Mill, 38 in. New Pattern.
Bolt Cutter 1 1-2 in. Sellers, good order.
Pipe Machines, 2 and 6 in. New Pattern.

Send for Complete List.

J. J. McCABE,
SUCCESSOR TO
E. P. BULLARD'S
N. Y. Mach'y Warerooms.
68 Cortlandt Street,
NEW YORK.

TURRET MACHINES

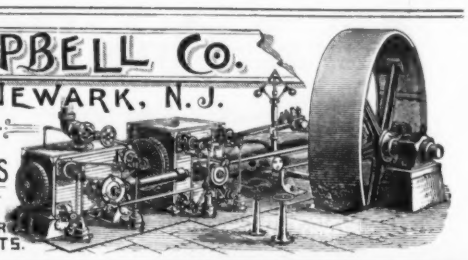
BRIDGEPORT MACHINE TOOL WORKS~E.P.BULLARD PROPR. BRIDGEPORT CONN.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY

NEWARK, N.J.

CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.



Eclipse Corliss Engine.

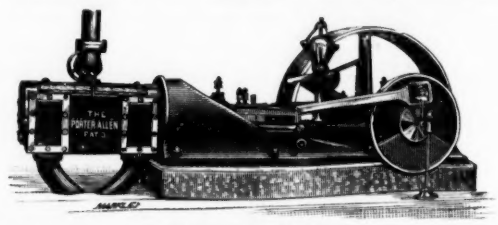
FRICK COMPANY, Builders.
WAYNESBORO, PA.

NON-CONDENSING, CONDENSING COMPOUND.
40 TO 1,000 H.P.
Send for Circulars.

ICE-MAKING AND REFRIGERATING MACHINERY.
Send for Special Circular.

A GENUINE "CORLISS."

SOUTHWARK FOUNDRY & MACHINE CO., PHILADELPHIA, PA.



SOLE MAKERS OF THE

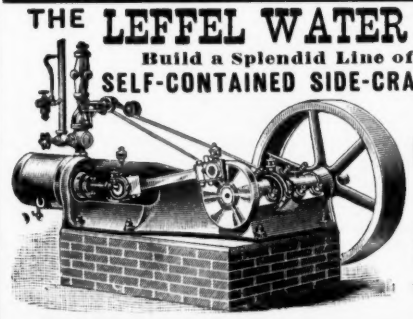
PORTER-ALLEN AUTOMATIC ENGINE.

ALSO BUILDERS OF

Blowing Engines, Reversing Engines, Hydraulic Cranes,
Centrifugal Pumps, Accumulators, Boilers, Tanks, etc.

THE LEFFEL WATER WHEEL AND ENGINE CO.

Build a Splendid Line of SELF-CONTAINED SIDE-CRANK

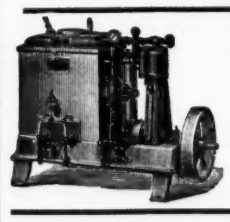


ENGINES
—AND—
RETURN FLUE **BOILERS**

8, 12, 16 and 20 Horse Power.

High in Grade. Low in Price. Strictly First-class. In design and construction SUPERIOR to all others. Write for ENGINE PAMPHLET.

Address us in full as follows:
THE LEFFEL WATER WHEEL & ENGINE CO.
Greenmount Ave., SPRINGFIELD, OHIO, U. S. A.



NO SKILLED ENGINEER

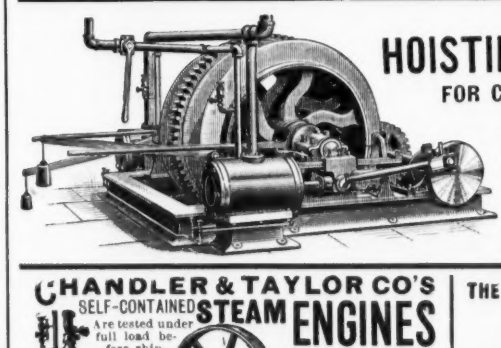
THE SHIPMAN AUTOMATIC STEAM ENGINE.

PETROLEUM, KEROSENE OR NATURAL GAS FUEL.

1, 2, 4, 6 and 8 horse-power.

Stationary and Marine. Automatic in Fuel and Water Supply.

SHIPMAN ENGINE CO.,
Send for Catalogue. 242 Summer St., Boston, Mass.



WIRE ROPE

HOISTING & HAULAGE PLANTS

FOR COAL MINES, &c., A SPECIALTY.

OVER 100 NOW RUNNING SUCCESSFULLY.

Gum-lined Sheaves, Coal Crushers, Narrow Gauge Locomotives.

J. & J. B. MILHOLLAND,
240 Fifth Avenue, PITTSBURGH, PA.

CHANDLER & TAYLOR CO'S STEAM ENGINES

SELF-CONTAINED

Are tested under full load before shipment.

12 to 80 H.P. in Stock

ALSO SUITABLE

BOILERS

on hand for immediate delivery.

For Circulars address
CHANDLER & TAYLOR CO. INDIANAPOLIS, IND.

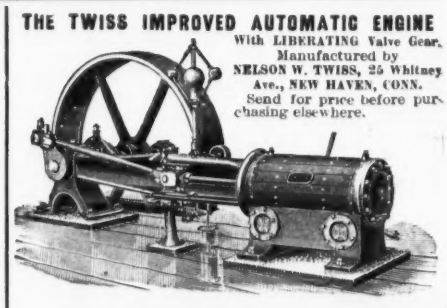
SECOND-HAND MACHINERY.

Planer, planes 54 inch wide, 24½ feet long, 2 heads, Betts Machine Co.
Planer, planes 72 inch wide, 12½ feet long, 2 heads, L. W. Pond Machine Co.
Planer, planes 36 inch wide, 10 ft. long, L. W. Pond.
Planer, planes 30 inch wide, 8 ft. long, D. W. Pond.
Planer, planes 30 inch wide, 8 ft. long, E. Harrington & Son.
Planer, planes 30 inch wide, 5 ft long, Cove Machine Co.
Planer, planes 24 inch wide, 6 ft. long, Harris.
Planer, planes 24 inch wide, 5 ft. long, L. W. Pond.
Gap Engine Lathe, 28 inch swing over shears, 56 inch swing in gap, 26 ft. bed, English Make.
Engine Lathe, 54 inch swing, 21 ft. bed, Putnam Machine Co.
Engine Lathe, 24 inch swing, 20 ft. bed, with three tool shafting rest, D. W. Pond.
Engine Lathe, 18 inch swing, 6 ft. bed, Sheppard Lathe & Co.
Engine Lathe, 16 inch swing, 8 ft bed, Wheeler.
Engine Lathe, 15 inch swing, 8 ft bed, Porter.
4 Engine Lathes 20 inch swing, 8 ft. bed, Ames Mfg. Co.
One 84 in. Swing by 20 ft. bed Lathe.
Shaping Machine, 9 inch stroke, New Haven Mfg. Co.
Upright Drill, 30 inch swing, back geared and self feed, Hawes Machine Co.
Upright Drill, 28 inch swing, Putnam Machine Co.,
Bolt Cutting Machine, 1 1-4 inch, Wm. Sellers & Co.
Bolt Cutting Machine, 1 1-4 inch, Schlencke.
Slotting Machine, 9 inch stroke, New Haven Mfg. Co.
Pipe Cutting Machine, 4 inch, Morris, Tasker & Co.
30 inch Boring Mill.
Large Index Milling Machine.
Two Double Stay Bolt Cutters, Bement.
One 28 inch Upright Drill, B. G. & S. F., J. E. Snyder, new.
One 36 inch " " " J. E. Snyder, new.
One Horizontal Engine, 10 inch Cylinder, 14 inch stroke.
One 15 Horse-Power Upright Boiler.

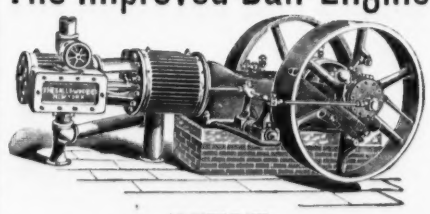
GEORGE PLACE, 120 Broadway, New York.

THE TWISS IMPROVED AUTOMATIC ENGINE

With LIBERATING Valve Gear.
Manufactured by
NELSON W. TWISS, 25 Whitney Ave., NEW HAVEN, CONN.
Send for price before purchasing elsewhere.



The Improved Ball Engine



AS BUILT BY

THE BALL & WOOD CO.
Office, 15 Cortlandt St., New York,

Is superior in DESIGN, FINISH and WORKMANSHIP. In REGULATION and ECONOMY it has no equal. Built with new tools, from new patterns and after long experience, it should and DOEs mark the latest step in steam engineering.

"THE MACHINERY TRADE.

There are evidences that the unusually good crops here, combined with an uncommon scarcity of food crops abroad, is having its effect in restoring the confidence necessary for the initiation of new business and manufacturing enterprises, and in some lines of the machine trade there has been an improvement within the past few weeks.

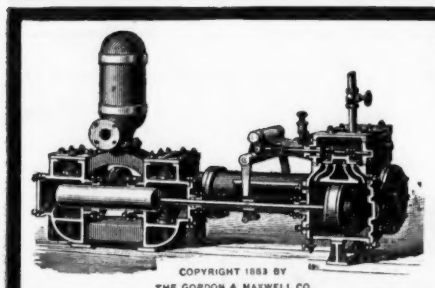
This is a good time to prepare for business."

American Machinist, Sept. 17, 1891.

Machines for working Iron and Steel, in stock.

BROWN & SHARPE MFG. CO.,

PROVIDENCE, R. I.



Duplex Steam Pumps

AND

Water Works Machinery.

THE GORDON STEAM PUMP CO.

HAMILTON, OHIO.

BRANCH HOUSES:
NEW YORK, 98 Liberty Street.
PHILADELPHIA, 705 Arch Street.
PITTSBURGH, Lewis Block.
CHICAGO, Phenix Building.

CRANES THE YALE & TOWNE MFG CO., STAMFORD CONN. NEW YORK CHICAGO PHILA. BOSTON

JENKINS STANDARD PACKING will pack a joint, no matter how rough or uneven the surface is.

The action of steam and heat on **JENKINS STANDARD PACKING** softens it, and by following up the joints, fills all cracks, &c. The continued heat on **JENKINS STANDARD PACKING** vulcanizes it, and it becomes hard as, and will last as long as metal itself, for the **JENKINS STANDARD PACKING**

does not ROT or BURN OUT. *JENKINS BROS., New York, Philadelphia, Boston & Chicago.*

THE LODGE & DAVIS MACHINE TOOL CO.,

WORKS—CINCINNATI, O.

—BUILDERS OF—

Machine Shop Outfits.

EASTERN HOUSE, 64 Cortlandt St., New York City.
WESTERN HOUSE, 68 & 70 S. Canal St., Chicago, Ill.
PITTSBURGH HOUSE, cor. Market & Water Sts., Pittsb'gh, Pa.

BOSTON OFFICE:
23 & 25 Purchase Street, Boston, Mass.
PHILADELPHIA OFFICE:
19 North Seventh Street, Philadelphia, Pa.

Write for large cuts with full descriptions.

Sole Agent for Great Britain,
ALFRED HERBERT,
Coventry, England.

24, 26, 32 and 36-inch Iron Planers.

See Advertisement, Page 16.

GOULD & EBERHARDT

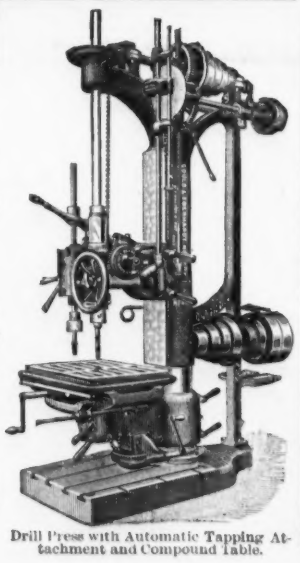
NEWARK, N. J., U. S. A.

BUILDERS OF

HIGH-CLASS MACHINE TOOLS.

INCLUDING

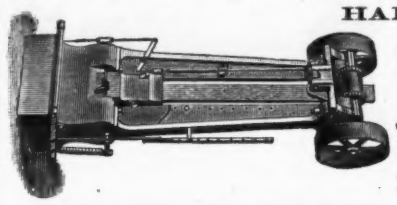
EBERHARDT'S PATENT
DRILL PRESS AND TAPPING ATTACHMENT.
STANDARD DRILL PRESS.
Double Triple Quick "Stroke" Shapers.
ENTIRELY AUTOMATIC GEAR CUTTERS.
Write for Circulars.



Drill Press with Automatic Tapping Attachment and Compound Table.

THE PRATT & WHITNEY CO.,

HARTFORD, CONN.



MANUFACTURE

DROP HAMMERS,

PUNCHING AND TRIMMING PRESSES,

—POWER SHEARS.—

Die-Sinking Machines, Hand Bolt Heading, Power Screw and Bolt Blank Heading Machines.

RETRACTILE JIB CRANES,

Roll Grooving Machines for Flour Mill Use.

PRICE LIST AND DISCOUNT SHEET SENT UPON APPLICATION.

WESTERN BRANCH, 100 West Washington Street, Chicago, Ills.

THE BILLINGS & SPENCER CO.,

HARTFORD, CONN., U. S. A.,

Manufacturers of

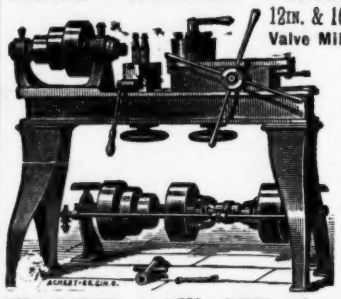
BILLINGS' PATENT CUTTING-OFF TOOL.

The Holder is drop forged, of steel, and finished in a thorough manner. The Cutters are made of the best tool steel and furnished in the following thicknesses: 1/16, 5/32, 1/8, 5/32, 3/16, 7/32, 1/4.

Drop Forgings of Bronze, Copper, Steel and Iron of all descriptions.

London House: CHAS. CHURCHILL & CO., L't'd, 21 Cross St., Finsbury, London, E. C., Eng.

BRASS WORKING MACHINERY.



12IN. & 16IN. MONITORS,
Valve Milling Mach's
Double Key Lathes,
Speed Lathes,
Slide Rests,
Revolving Chucks for Globe Valves
Two-Jawed Chucks,
Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

MANNING, MAXWELL & MOORE,

Manufacturers and Dealers in all kinds of RAILWAY and MACHINISTS' **TOOLS AND SUPPLIES,**

The Celebrated F. E. REED 16-inch Swing Engine Lathe.

111-113 LIBERTY ST., NEW YORK.

We carry the largest line of Tools and Supplies in the City.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, PRESIDENT.
WM. B. FRANKLIN, VICE-PRESIDENT.
F. B. ALLEN, SECOND VICE-PRESIDENT.
J. B. PIERCE, SECRETARY & TREASURER.

Key-Seating Machines and 20 in. Drills

A SPECIALTY.

SEND FOR LIST OF

New and Second-Hand

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,

Rochester, N. Y.

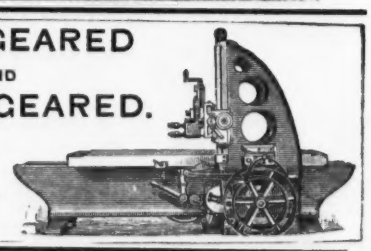
GRANT'S GEAR WHEELS and GEAR CUTTING of every kind and all sizes, ready made or made to order. New Treatise on Gears for Also Send for Catalogue or Estimate
LEXINGTON GEAR WORKS, LEXINGTON, MASS.

PLANERS SPUR GEARED AND SPIRAL GEARED.

MANUFACTURED BY

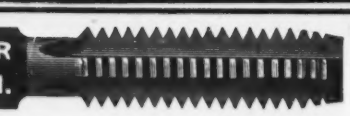
The G. A. GRAY CO.,

479 Sycamore St., CINCINNATI, O.



2½" Cutting-Off Machine.
20" × 6' Chucking Lathe.
27" × 27" × 8' Planer.
THE HENDEY MACHINE CO TORRINGTON, CONN. SEND FOR OUR CATALOGUE
MANUFACTURERS OF MACHINE TOOLS

J. M. CARPENTER PAWTUCKET, R. I.



Manufacturer —of— TAPS & DIES